Vol. XX No. 4

DISSERTATION ABSTRACTS

ABSTRACTS OF DISSERTATIONS AND MONOGRAPHS IN MICROFORM

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ANN ARBOR, MICHIGAN
1959

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AGRICULTURE, GENERAL

EFFECT OF ACREAGE CONTROL PROGRAMS ON CROP AND LIVESTOCK OPERATIONS ON SELECTED MICHIGAN FARMS.

(L. C. Card No. Mic 59-2631)

Charles Louis Beer, Ph.D.
Michigan State University, 1957

This study was designed to test the hypothesis that land taken out of the production of controlled crops is likely to be used to produce other feed or cash crops in order to make full use of available labor or other resources available on the farm. A second hypothesis is that price support programs are more likely to be used by those farmers in Michigan who have larger total production of crops.

The sample areas were selected to be representative of various important commercial farming areas of Michigan. Complete description of the sampling procedure and a brief census description of each area is given in Chapter I.

This study has been confined to the specific area of price support and acreage control programs. It shows the relationship between acreage control and the use of diverted acres on a group of sample farms. It also shows the changes planned in the livestock operations on these farms.

A large proportion of the farmers interviewed in this study made no use of price supports on their crops and many who did use supports used them on only one crop. It is worth noting that price supports and controls were administered through the basic crops on the assumption that sufficient interaction would occur throughout the crop and livestock programs to decrease the supply and increase the price. This and other studies indicate that there was little change in total crop acreage although there was some reduction in the acreage of wheat. Only a small amount of the diverted acreage was left idle. The largest portion of it was planted to other feed or cash crops.

Approximately 3,300 acres were taken out of the production of controlled crops, (wheat and corn), because of the acreage allotments and marketing quotas by the 414 farmers interviewed in this study. Four crops accounted for the use which was made of 65 percent of this land. In the order of their importance, they are: Oats, 24 percent; dry beans, 16 percent; barley, 13 percent; corn, 12 percent. About 11 percent of the diverted acreage was used as summer fallow or idle land. One should note, however, that the total land in summer fallow and idle was less in 1954 than in 1953.

This study shows that 65 percent of the land removed from the production of controlled crops, (wheat and corn), in Michigan was used to produce other feed crops and 24 percent of the diverted acreage was used to produce other cash crops.

This extra production of feed crops, about 2,150 acres on 414 farms, would lead one to expect some expansion in livestock numbers to make use of the additional feed. Chapter III shows that approximately 440 tons of forage and 1,450 tons of feed grains would have been produced on the land diverted from allotments and planted to feed crops by the 414 farmers in this study. This would be sufficient feed to carry approximately 2,100 additional animal units of livestock on these farms.

Farmers with larger amounts of land in diverted acreage appeared more likely to be planning changes in livestock on their farms than those farmers who had smaller amounts of land in diverted acreage. Examination showed that those farmers reporting diverted acres and planning livestock changes, were likely to be planning increases of beef or hogs in a much higher ratio than these two enterprises held in the overall sample of farmers interviewed.

The results of this study support the hypothesis that price support programs are more likely to be used by those farmers in Michigan who have larger total production of crops (through larger acreages of these crops and better per acre yields).

This study also supports the hypothesis that land taken out of production of controlled crops is likely to be used to produce other feed or cash crops in order to make full use of available labor or other resources on the farm.

Other feed crops were produced on 2,150 acres of the 3,300 acres diverted from allotment crops. Only 10 percent, or about 330 acres, was planted to forage crops (hay or pasture). The remaining 1,820 acres of feed crop acreage consisted of feed-grains. Thus, the additional feed production on the 414 farms was approximately 1,890 tons of feed. This was made up of 440 tons of forage and 1,450 tons of feed-grains.

Contrary to expectation a relatively small amount of the diverted acreage was used for forage production. The use of diverted acreage for production of feed grains appeared to be encouraging the expansion of grain-consuming livestock on the sample farms.

Microfilm $2.00; Xerox $6.20. 129 pages.

A STUDY OF THE PREFERENTIAL RESPONSES OF HONEY BEES FORAGING VARIOUS LEGUMES IN NORTHERN MINNESOTA, AND CERTAIN FACTORS AFFECTING THESE RESPONSES.

(L. C. Card No. Mic 59-3744)

Basil Furgala, Ph.D.
University of Minnesota, 1959

Certain factors affecting the pollination of sweetclover, alfalfa, alsike clover and red clover in northern Minnesota were studied.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The existing absolute colony density of only 1/3 to 1/2 colony per acre of crop, together with the criteria used by bee-keepers to establish apiary locations were significant factors contributing to the acute insufficiency of pollination in the area.

The establishment of a blanket recommendation, regardless of crop species is proposed. A tentative absolute colony density of one colony per crop acre is suggested.

Foraging honey bees were observed to exhibit preferences for specific legumes.

When colony density was increased 49%, foraging populations and seed yields were increased 113% and 119% respectively.

Honey bees "worked" the various crops at different rates. Sweetclover was foraged most rapidly, followed by alsike clover, alfalfa and finally red clover. Field observations and laboratory dissections indicated remarkable differences in the foraging behavior of honey bees. The data indicated that sweetclover and alfalfa were the preferred nectar sources; alsike clover and red clover the preferred pollen sources.

The predominant pollen observed on the fossal regions of honey bees foraging sweetclover, alsike clover and red clover was invariably the pollen of the crop upon which the bees were captured. The predominant pollen on the fossal regions of honey bees foraging alfalfa, was, without exception, pollen of one of the former three crops rather than alfalfa pollen. The value and limitations of using this criterion in determining the proportion of a pollinating force foraging a specific crop is noted.

Red clover and alfalfa florets contained 5 - 9 times more nectar than did either sweetclover or alsike clover. Therefore, amount of nectar did not appear to be the factor determining nectar preference.

Under the conditions of the study, honey bees were capable of collecting nectar from a reasonable number of the red clover florets visited.

The equivocal term "available nectar" was discussed. It is proposed that this term be replaced by "accumulated nectar" to denote the nectar present in a crop floret, and "collected nectar" to represent the amount of nectar which the honey bees are able to glean.

Sucrose, glucose, fructose, maltose and at least three other trace unidentified sugars were recovered from the crop nectars by paper chromatography. Marked variation in the sugar composition and the proportions of the various constituent sugars, both within and between crops was encountered.

An apparent relationship between the relative molar concentration of sugars in the various crop nectar samples, and the relative populations of foraging honey bees was obtained.

The need for a complete re-evaluation of the problem and factors affecting crop preferences is discussed.

Microfilm $2.00; Xerox $5.80. 118 pages.

NUTRITIONAL STATUS OF NEW JERSEY PEACH ORCHARDS AND POTASSIUM NUTRITION OF PEACH TREES.

(L. C. Card No. Mic 59-3578)

Edwin Peter Griffin, Ph.D.
Rutgers University, 1959

Major Professor: Dr. E. R. Purvis

A survey was made of the nutrient status of 69 commercial peach orchards in 14 counties of New Jersey by means of soil analyses, and of 19 commercial orchards by means of both leaf and soil analyses. A field study was carried out in six commercial peach orchards, using three varieties of peach, each in two locations, to determine peach tree response to K fertilization. Three orchards were located on soils of the Coastal Plain Province, and the other three were on soils of the Appalachian Province. Correlation studies were made between the nutrient content of peach leaves and the available Mg, P and K in the soil, and between nutrient content of the leaf, or soil, and measurements of tree response.

The nutrient composition of the leaves and soils from the survey of commercial peach orchards revealed very few instances of nutrient deficiencies. Differences in nutrient content between samples collected from under the trees and from row middles were negligible. Topsoil samples were considerably higher in available P and K than subsoil samples. In differentiating between samples from the Coastal Plain and Appalachian Provinces, it was found that Coastal Plain Province soils were higher in available P and K, lower in available Mg, and had a lower pH than Appalachian Province soils. Leaf analysis indicated a higher content of N and K, and a lower content of Ca and Mg in leaves from orchards of the Coastal Plain than of the Appalachian Province. Little difference in P content of leaves was observed between the two provinces.

In field studies available soil K and leaf K was increased significantly as a result of K fertilization, whereas available Mg and P and the pH remained relatively unchanged. In the second year of the experiments the leaf content of Ca and Mg was significantly decreased in several instances. Leaf N and P were relatively unaffected by K fertilization.

A response of peach trees to K fertilization was observed in some orchards in terms of an increase in fruit bud formation, fruit set, fruit drop, fruit size, earliness of maturity, and a decrease in the per cent of soluble solids in the juice of the fruit.

Measurements of tree growth and yield could not be related to K treatments.

Correlations of leaf analysis with soil analyses from the survey of New Jersey peach orchards were not always in agreement with similar correlations from the six experimental orchards.

The correlation coefficients revealed several points worthy of mention. There was a significant positive correlation between leaf K and soil K. Leaf K and soil K were for the most part inversely and significantly correlated with leaf Ca and leaf Mg.

Neither peach yield or shoot growth was closely related to leaf K or soil K, however, the number of fruit set per inch of shoot, correlated very well with both leaf and soil K in several orchards.

Correlations of soil K with other variables, differed with the time and depth of the soil sample.

Microfilm $2.00; Xerox $5.00. 100 pages.

A STUDY OF INSECTICIDE ADHESIVES AND METHODS FOR DETERMINING THEIR EFFECTIVENESS IN THE LABORATORY.

(L. C. Card No. Mic 59-3605)

Harrie Moffet Taft, Jr., Ph.D.
Rutgers University, 1959

Major Professor: Dr. Andrew J. Forgash

Nine insecticide adhesives were examined to determine their effectiveness in preventing removal by simulated rainfall of insecticide wettable powder formulations to which they had been added. In addition, the effects of toxicant, carrier, and carrier particle size on adhesiveness of wettable powders were determined. Two laboratory methods were devised for this evaluation: a colorimetric stain method which related stain density in a stripping solvent to quantity of formulation on a sprayed surface, and the cylinder adherence method which, through the use of a device for measuring the force required to separate cylinders from a dried wettable powder, determined the physical adhesiveness of a deposited formulation. In addition, adhesiveness of formulations was examined using a bio-assay method and analyses of insecticide residues of field applications. The two laboratory methods were in general agreement, and the retention ratings of DDT wettable powders made by the colorimetric method agreed with those made by chemical analysis of DDT. In the colorimetric method, it was found that waxed slides could be substituted for leaves when the two surfaces did not differ significantly. Both the colorimetric and cylinder adherence tests with wettable powders which were specially formulated to be identical except for the toxicants, demonstrated that the inherent adhesiveness of the toxicant in a wettable powder determined, in large part, the adhesiveness of the deposited formulation. A wettable powder containing lindane, a highly-refined toxicant, was the most adhesive of those tested. Most stickers tested, when added in excessive concentrations, decreased deposition but, in some cases, significantly increased total retention of wettable powders. The particle size of the carrier also affected the adhesiveness of wettable powders. For example, a wettable powder made with a fine fraction of attaclay was more adhesive than one made with a coarse fraction. In the cylinder adherence tests, DuPont, Genifilm, and Ortho seemed to function primarily as wetting and/or spreading agents while Plyac, Protovac, Darex, National and Filmfast appeared to function primarily as stickers. A DDT wettable powder made with bentonite was significantly more adhesive than the formulations made with montmorilonite, talc, kaolin, or attaclay. It appeared from the results of the laboratory tests that the adhesiveness of wettable powders was influenced to a greater extent by the toxicant, carrier, and carrier size, than by the sticker, and that none of the stickers included in the field tests affected the adhesiveness of the wettable powders sufficiently to warrant their incorporation into the formulation.

Microfilm $2.00; Xerox $5.80. 120 pages.

RELATIONSHIPS BETWEEN MILK PRODUCTION AND TYPE RATINGS OF HOLSTEIN FEMALES WITH CORRECTIONS FOR IMPORTANT ENVIRONMENTAL FACTORS.

(L. C. Card No. Mic 59-3612)

Charles Julian Wilcox, Ph.D.
Rutgers University, 1959

Major Professor: K. O. Pfau

The objectives of this investigation were (a) to measure and evaluate the effects of several environmental factors upon type ratings and subratings, and (b) to establish correlations between type ratings, adjusted for these environmental factors, and several measures of milk production. Available for study by electronic computation techniques were 671 lactation records of 339 animals, and 4687 type ratings accumulated from semi-annual official type classifications of the New Jersey Agricultural Experiment Station Holstein herd from 1945 to 1957.

Preliminary investigations indicated that (a) scores of animals by different classifiers varied considerably; consistent differences in ideals accounted for 1 to 13% of this variability, but a fluctuation of standards within and among classifiers accounted for 27 to 45%, (b) although scores of animals prior to freshening were positively correlated to ratings during the first lactation, correlations were not high enough to justify the use of these ratings for prediction purposes; immature ratings were not included in the studies of type and production, and (c) age of cow, season of year, and stage of lactation systematically influenced type scores and their combined effects accounted for up to 12% of the total variation.

Comprehensive analyses employing electronic computation techniques and including 2272 classifications of 233 animals measured the effects of age, season, stage of lactation, classifier, and calendar year simultaneously and independently of each other. Each was shown to affect type ratings to a highly significant degree and the following trends were indicated; (a) ratings improved with age consistently from the first to the sixth lactation, (b) spring ratings were higher than fall ratings, (c) scores were higher in early- and late-lactation than in mid-lactation, except for dairy character which decreased in late-lactation, (d) classifiers differed in their mean scores to a marked degree with ranges among subratings being greater than among the over-all ratings, and (e) scores decreased slightly, but significantly, and in a linear manner, over the 13-yr. period. Adjustment factors based on the total and within-cow variation were similar; adjustment of ratings for the five environmental factors accounted for up to 28% of the variation.

Total, among-cow, and among-lactation within-cow correlations between type ratings and milk yield, highest yield, fat-corrected yield, fat yield, and fat percentage were obtained. Correlations were highest among-cows

and lowest among-lactations within-cows. Fat percentage was not correlated to type; correlations between type and the remaining measures of milk production were very similar but slightly higher for highest yield, followed by milk yield, fat-corrected yield, and fat yield. On an among-cow basis, highest yield was correlated with type ratings to the following degree; over-all rating (+0.27), general appearance (+0.26), dairy character (+0.37), body capacity (+0.20), and mammary system (+0.27). Correlations among rump, feet and legs, and fore udder ranged from +0.12 to +0.25.

Type scores were not shown to be good indicators of milk production. Since dairy character was more closely related to milk production than the over-all rating or any of the remaining subratings, greater emphasis should be placed on ratings of dairy character both in attempts to increase agreement among inspectors (now only +0.56) and to increase its relationship to over-all rating (now +0.64). Microfilm $2.00; Xerox $4.20. 79 pages.

AGRICULTURE, ANIMAL CULTURE

EQUIVALENCY OF CAROTENE TO VITAMIN A IN THE BOVINE.

(L. C. Card No. Mic 59-3865)

Joseph Edward Rousseau, Jr., Ph.D.
The University of Connecticut, 1959

Although carotene requirements for prevention of papillary edema and an elevated cerebrospinal fluid pressure have been determined and found to be more sensitive criteria of vitamin A deficiency than growth or night-blindness, data with respect to vitamin A per se on these criteria were unreported. The objective of an initial study was therefore, to determine quantitatively the equivalency of carotene to vitamin A employing as criteria elevated cerebrospinal fluid pressure, occurrence of papillary edema and tissue alterations, and in addition blood and liver concentrations of vitamin A.

Forty 63-day old Holstein male calves previously raised on a limited whole milk - dry calf starter regime, were fed an intake of a vitamin A depletion ration to give an anticipated 10 lb. increase in body weight per 7-day period until the blood plasma vitamin A concentration decreased to 10 γ% or less. Each calf was then fed in addition to the depletion ration one of five levels of carotene, from artificially dehydrated alfalfa, 12, 18, 24, 30 and 36 γ or one of five levels of vitamin A, from a dry carrier, 2, 4, 6, 8 and 10 γ per pound of live weight daily, for 16 wks.

The results of this study showed that the minimum requirement for the maintenance of a "normal" cerebrospinal fluid pressure (<120 mm. H_2O) was between the 30 and 36 γ level of carotene and the 6 and 8 γ level of vitamin A. An intake greater than 36 γ of carotene and between the 8 and 10 γ level of vitamin A was required to prevent papillary edema. To prevent squamous metaplasia of the parotid gland the 30 γ level of carotene and the 6 γ level of vitamin A were required.

Plasma vitamin A concentrations were found to be proportional to the logarithm of the carotene or vitamin A intake, whereas the logarithm of liver vitamin A concentrations were proportional to the logarithm of the carotene or vitamin A intake.

A second study was then designed to obtain a range of responses in blood and liver concentrations of vitamin A and vitamin A depletion time which would more adequately describe the functional relationships between response and intake. In the first study the validity of the relationships in describing a wide portion of the response range was open to question since the responses and intakes covered only a limited range.

Forty-eight 63-day old Holstein calves, treated previously as those of the first experiment, were supplemented with one of three levels of carotene from artificially dehydrated alfalfa, 60, 180, and 540 γ or one of three levels of vitamin A from a dry carrier, 5.5, 10.8 and 21 γ per pound of live weight daily for 12 weeks.

The results of this study showed that the regressions of plasma vitamin A and the logarithm of the liver vitamin A concentrations were linearly related to the logarithm of the carotene or vitamin A intake. Vitamin A depletion time expressed in weeks was linearly related to the actual carotene or vitamin A intake. The slopes of these regression lines were larger in the case of vitamin A supplementation than of carotene supplementation and substantiated the widening in the equivalency of carotene to vitamin A as the intake levels were increased. From the relationships of plasma and liver vitamin A concentrations and vitamin A depletion times on carotene or vitamin A intake, carotene on a weight basis was 1/5th to 1/6th as effective as vitamin A at the 60 γ carotene intake level, 1/10th to 1/13th at the 180 γ level and 1/20th to 1/23rd at the 540 γ level.

Microfilm $2.00; Xerox $3.00. 59 pages.

AGRICULTURE, FORESTRY AND WILDLIFE

A STUDY OF THE ECOLOGY OF MALE RUFFED GROUSE (BONASA UMBELLUS L.) ON THE CLOQUET FOREST RESEARCH CENTER, MINNESOTA.

(L. C. Card No. Mic 59-3742)

Robert Lloyd Eng, Ph.D.
University of Minnesota, 1959

A study of the ecology of the male ruffed grouse (Bonasa umbellus L.) was conducted on the Cloquet Forest Research Center, Minnesota from September 1955, to July 1958. King strip counts, roadside drumming counts and total counts of drumming males on unit areas indicated similar trends in the spring populations. A slight decrease was observed from 1956 to 1957 and a slight increase from 1957 to 1958. Banding and marking for studies of movement and survival were made by the use of mirror traps (100 captures), clover-leaf traps (150 initial captures, 120 recaptures), tip-top traps (2 captures),

and nest enclosures (25 captures). The observed inverse relationship between spring male populations and the percent of adult males present is discussed with respect to activities and mortality of the male bird. Movement data of the male bird are discussed with respect to the following segments of its life history: brood period, fall dispersal, period of establishment and adult period. Distinct brood ranges were observed although a degree of overlapping occurred. Brood break-up appeared to be initiated by juvenile males. Dispersal movements of this group showed a relationship to the fall drumming sequence of adult males. This relationship is discussed. Following fall dispersal of juvenile males, the birds exhibited tendencies to become established and later selected adult home ranges in the same area. Juvenile females showed a similar pattern, although the dispersal from the brood ranges occurred later and in a more gradual manner. These movements appeared to be governed by the location of favored feeding areas. Adult males showed very restricted movements. The average distance these birds were observed from the drumming log during the spring was 114 feet, with averages for the summer, fall and winter, respectively, being 3.3, 2.9 and 5.6 times as great. Adult females exhibited movements two to three times as great as adult males. The data obtained showed that adult females did not participate in fall dispersal movements of juveniles. A quantitative evaluation of the vegetative cover at 46 drumming sites provided data indicating tree density to be the most variable factor, shrub cover the next and a combination of the two-overhead cover the least variable. Data are presented and discussed in relation to the selection of drumming sites by juvenile males. This activity is discussed with respect to time of selection and its relationship to population densities and habitat occupation.

Microfilm $2.00; Xerox $5.80. 119 pages.

SITE AND ROOT STUDIES OF RED PINE (PINUS RESINOSA AIT.) PLANTATIONS IN LOWER MICHIGAN.

(L. C. Card No. Mic 58-7114)

Willem Adolph van Eck, Ph.D.
Michigan State University, 1958

This study was designed to find an expression for the relation and absolute production capacity of Michigan soil series in terms of wood production over time. It was also meant to indicate inadequacies in the present soil classification system in its application to forest lands. The basis of this study was the information obtained from one hundred and twenty carefully selected one-tenth acre sample plots in seventy-five different red pine plantations. The survey covered twenty-six soil series.

From the stand data collected in plantations over a wide range of site conditions and in a number of natural stands a set of polymorphic site curves was constructed. Maximal rate of growth on the height growth curve was used as a major criterion to differentiate between the five site classes recognized. Using these curves, to the stands on each site could be attached a site index, depending on age and mean height of dominants and expressed in terms of expected height at age fifty years. Site index was used as an expression of site productivity and was also a measure of soil productivity as sample plots were selected so that the soil profile was essentially the only variable site factor.

Site indices for the range of soils studied varied between thirty-six and seventy-four feet and maximal growth rates varied from 0.8 to 2.1 feet per year.

Low values were associated with weakly podzolized well-drained coarse sandy glacial drifts which had not been cultivated previous to cultivation. Within the sands, deviations from this extreme site, in terms of higher amounts of the fine sand fraction or increasing degree of podzolization or the presence of groundwater within the rootzone, produced higher site indices and higher maximal growth rates. Absence of a plowlayer on the sands was responsible for a longer period of initial stand establishment. This factor strongly depressed the site index but did not greatly affect maximal growth rate on sites where other soil characteristics were favorable for a normal growth rate after initial establishment.

High site index values were associated with previously cultivated podzolized sands overlying fine textured materials at depths of more than eighteen inches.

Intermediate site indices were found for moderately coarse to moderately fine textured soils. The low values in this range were correlated with the presence of groundwater, compacted subsoils, very stony or gravelly horizons and free carbonates within or near the surface eighteen inches. Subsequent root studies showed that these characteristics apparently limited the effective depth to which the rootsystem could penetrate and branch out. Growth curves on these sites showed a normal pattern until the effect of the limiting factor became evident by a sharp decline in growth or by the actual death of trees.

A generalized conclusion is that forest soil classifications for sands should stress the characteristics which affect available soil water, in the rootzone, and for finer textured soils the characteristics which inhibit root penetration within the upper eighteen inches of the profile.

As judged from site index data for soil series on which more than five plots were sampled, the error of estimate of the site index of individual stands is between eight and thirteen percent of the actual value.

When the stands studied were grouped by site class on the basis of estimated site index it was shown graphically that for any age class red pine on better sites had a higher mean diameter and higher basal area.

The trends in the assembled stand data on plantations and in yield data on natural stands from the literature were the basis of proposed management plans for planted red pine designed for six different types of rotation. The economics of each scheme was evaluated on the basis of current price levels and two different interest rates.

Part II of this thesis contains detailed morphological descriptions and photographic illustrations of red pine root systems on sixteen different sites. The relation of roots to the associated soil profiles is indicated and the possible effect of these relationships on tree growth is discussed. Microfilm $4.25; Xerox $14.20. 330 pages.

AGRICULTURE, PLANT CULTURE

RELATIVE EFFECTIVENESS OF SELECTION FOR QUANTITATIVE TRAITS IN F_2 OF CROSSES AMONG RELATED AND UNRELATED LINES OF OATS.

(L. C. Card No. Mic 59-3743)

Pedro Bolivar Escuro, Ph.D.
University of Minnesota, 1959

Adviser: W. M. Myers

Three related lines and an unrelated variety of oats were crossed in all possible combinations with the object of comparing the relative effectiveness of selection from the F_2's of two groups of crosses, the groups differing in the degree of genetic relationship of the parents. The parents of the crosses differed in only two of the six quantitative traits studied. The F_2's and the parents were grown in three replicates in 1957 and the parents, F_1's and F_3 plant progenies of random F_2 selections from each cross were grown in two replicates in 1958. Bulked seed of both random and superior F_2 plants selected for each of the six traits were also grown in five replicates in 1958.

Estimates of genotypic variances and heritabilities were calculated from the F_2 plant and F_3 progeny-mean data while estimates of additive and non-additive genetic variances and heritability in the narrow sense were calculated from the variances among and within F_3 progenies. Predicted gains were calculated and compared with the observed gains in F_3.

Estimates of genotypic variances and corresponding heritabilities were generally higher in the crosses among unrelated lines for all traits except panicle length in which there was no mean difference. Large estimates of additive genetic variance and heritability in the narrow sense were also associated with this group of crosses for date of heading, plant height and seed weight. The mean estimates for panicle length appeared to be essentially of the same magnitude in both groups of crosses if considerations were given to the relatively high estimates obtained for two of the six crosses among related lines. All of the genotypic variance for date of heading could be attributed to additive gene effects while for number of panicles and grain yield to non-additive gene effects except for one cross between related lines.

The mean observed gains for all six traits in F_3 were larger in the crosses among unrelated lines than in those whose parents were related. Selection was effective in raising the means of the F_3 progenies of the F_2 selections except for yield in both groups and for number of panicles in the crosses among related parents. In general, there were good agreements between the mean predicted gains calculated on the assumption of additive gene action and the mean observed gains in F_3 for all traits if the upward bias due to non-additive gene effects were considered.

Microfilm $2.00; Xerox $4.40. 87 pages.

EFFECTS OF VARIOUS PLANT REGULATORS ON THE GROWTH AND DEVELOPMENT OF SELECTED HERBACEOUS ORNAMENTALS.

(L. C. Card No. Mic 59-2635)

Charles Allen Fountain, Ph.D.
Michigan State University, 1957

The effects of various plant regulators on the growth, morphology, flowering and chemical composition of selected herbaceous ornamentals has been studied. In addition, tests were conducted to determine the effects of an interaction of regulators and vernalization and the effects of an interaction of growth regulators and photoperiods on plant development.

To determine the effect of an interaction of chemicals and vernalization, foliage sprays of 5, 25 and 100 parts per million of maleic hydrazide, 2, 3, 5-triiodobenzoic acid, and indoleacetic acid were applied to candytuft and snapdragon seedlings. Germinating seed were treated with concentrations of 1, 5, and 10 parts per million of the above regulators. Seedlings and germinating seed were subsequently exposed to a temperature of $40 \pm 2^{\circ}$F for 2 or 3 weeks.

The effects on plant development of sodium trichlorobenzoate, 2, 3, 5-tribromobenzoic acid, 5-chlorosalicylic acid, and 2, 3, 5-triiodobenzoic acid were determined by spraying wallflower and phlox plants with concentrations of 100, 500, and 1,000 parts per million.

To determine the effects of repeated and single application of 2, 3, 5-triiodobenzoic to progressively older phlox plants, applications of 50, 100, 500 and 1,000 parts per million were repeated three times at weekly intervals. To other plants these concentrations were applied as single treatments to 2-, 3-, and 4-week old phlox.

Effects of an interaction of plant regulator and various photoperiods were determined by spraying phlox seedlings, which were growing under natural, 8-hour, 16-hour, and 24-hour photoperiods with 100, 500, and 1,000 parts per million of 2, 3, 5-triiodobenzoic acid.

Application of growth regulators did not affect the number of days from seeding to first flower of candytuft seedlings. During the spring application of plant regulators resulted in a decrease in number of days from seeding to flowering of snapdragons, however, when applications were made in late fall there was no significant effect on days to flowering. Generally, any acceleration of flowering was accompanied by an increase in nodes and weights of flowering plants.

An interaction of growth regulators and vernalization did not affect the number of days to flowering. However, vernalized seedlings required significantly fewer growing days to flowering than non-vernalized. Weights of plants were significantly reduced by vernalization. Chemically treated and vernalized germinating candytuft seeds generally flowered earlier than untreated vernalized seeds. Vernalized seed required fewer growing days to flowering.

All concentrations of chemicals resulted in delay of flowering in wallflower and phlox. Repeated and single applications of 2, 3, 5-triiodobenzoic acid to phlox also resulted in delay of flowering and reduction of weight.

The interaction of photoperiods and 2, 3, 5-triiodobenzoic acid on flowering of phlox was promotive only under the 8-hour photoperiod. Flowering was delayed by

chemical treatment under other photoperiods. Chemical composition of flowering plants was also affected under the 8-hour photoperiod where a decrease on carbohydrated was noted.

Pronounced morphological and teratological changes resulted from most chemical applications. The prevalence and magnitude of these changes were largely dependent upon chemical concentrations used, physiological activity of the chemical, plant type, and environmental conditions.

The results of the present research were discussed in view of the reports of others relative to the influence of chemical treatments, vernalization and photoperiods on the vegetative, flowering, morphological, and chemical responses in plants.

Microfilm $2.00; Xerox $6.40. 133 pages.

THE EFFECT OF PHOTOPERIOD AND LIGHT QUALITY ON THE VEGETATIVE AND REPRODUCTIVE GROWTH OF THE STRAWBERRY.

(L. C. Card No. Mic 59-3577)

James Gordon Gosselink, Ph.D.
Rutgers University, 1959

Major Professor: Dr. Carter R. Smith

Several greenhouse experiments were undertaken to study the photoperiodic responses of the strawberry, and to record the effects of supplementary red and far-red radiation on these responses.

The critical photoperiod for Sparkle strawberry plants grown at a night temperature of 70°F. was found to be between 12 and 14 hours.

The number of inductive cycles necessary for inflorescence initiation was variable. In one test the plants initiated inflorescences after 20 inductive cycles. In later tests 20 cycles were not sufficient to cause initiation in all plants.

Initiation followed induction by about 10 days. However there was some indication that after induction was complete initiation occurred more rapidly in long photoperiods than in short ones.

After initiation inflorescences emerged in a 16-hour photoperiod at the same rate as the leaves. In 8 and 12-hour photoperiods they emerged more slowly, apparently because the peduncle of the inflorescence did not elongate in these photoperiods. Flower parts matured normally in all treatments.

The length of successive plastochrons was unaffected by the photoperiod, but was influenced by the day temperature.

Leaf area and petiole length increased with increasing length of the photoperiod. The leaves emerging successively after differential treatments were started responded increasingly to the treatment until a maximum response was registered on the fifth or sixth leaf to emerge. The differences in petiole length among treatments were due almost entirely to differences in cell length, rather than in numbers of cells.

Red irradiation during the last half hour of a 12-hour photoperiod did not influence the flowering responses, nor the vegetative growth responses of strawberry plants, compared to plants in a check 12-hour photoperiod.

Plants receiving far-red irradiation after a 14-hour photoperiod had longer petioles on the first six leaves to emerge, than plants in a check 14-hour photoperiod. Both the red and the far-red irradiation decreased the rate of leaf production slightly over their respective controls, but this did not add up to a significant decrease in the total number of leaves produced.

Microfilm $2.00; Xerox $4.40. 83 pages.

A STUDY OF THE EFFECTS OF PHOTOPERIOD ON THE GROWTH AND DEVELOPMENT OF THE POTATO (SOLANUM TUBEROSUM L.) AT FAIRBANKS, ALASKA.

(L. C. Card No. Mic 59-3775)

Arvo Kallio, Ph.D.
University of Minnesota, 1959

During three years (1953-1955) Kennebec and Pawnee potatoes were grown under two short photoperiod treatments (12 hour photoperiod from emergence to harvest and 12 hour photoperiod from tuberization to harvest) and under normal photoperiod (ranging during the season from 14.8 hours to 21.9 hours).

Short photoperiods reduced top growth of both varieties but reduced top growth of Kennebec less than that of Pawnee. Short photoperiods reduced top growth of Kennebec less in 1953 than in 1954 whereas reduction in top growth of Pawnee did not vary between years.

The nitrogen content of potato tops reached a maximum approximately 30 days after emergence and decreased as the season advanced. The nitrogen content of plants under short photoperiods decreased less rapidly than that of plants under long photoperiod.

Photoperiod had no effect on stem number of either variety.

Flower bud formation was not affected by photoperiod but flower buds abscised without opening on plants grown under short photoperiods.

Tuber initiation was not influenced by photoperiod as tubers set equally early under both long and short photoperiods.

Tuber number tended to be slightly lower under plants exposed to short photoperiod beginning at the time of tuberization than under plants exposed to continuous long or short photoperiods beginning at emergence.

The influence of length of photoperiod on tuber yields varied with both variety and year. In general, short photoperiods reduced yields but under unfavorable environmental conditions they had less effect on yields than under favorable growth conditions. The yields of the midseason variety, Pawnee, were more consistently reduced by short photoperiods than were those of the late variety, Kennebec.

Average tuber weight of the Kennebec variety was greater than that of Pawnee. Short photoperiods reduced tuber weight of Pawnee but had only a slight effect on tuber weight of Kennebec.

Photoperiods used in this study had little, if any, influence on dry matter content of either variety.

Both varieties were more efficient in photosynthate production and/or carbohydrate storage under short photoperiods than under long photoperiods as indicated by tuber:top and leaf area:tuber ratios.

Microfilm $2.00; Xerox $4.80. 92 pages.

AN INVESTIGATION CONCERNING THE VARIABILITY OF PHYTIN AND OTHER INOSITOL PHOSPHATES IN CROP SPECIES AS DETERMINED BY THREE METHODS OF ANALYSIS.

(L. C. Card No. Mic 59-3587)

Richard John Marrese, Ph.D.
Rutgers University, 1959

Major Professors: Dr. M. A. Sprague
Dr. R. W. Duell

Phytin is an organic phosphate, defined by most investigators as the mixed calcium and magnesium salt of inositol hexaphosphoric acid (phytic acid). Half or more of the phosphorus of most mature seeds and the products processed from seed is reported as phytin. Phytin, then, is an important constituent of the total phosphorus in seeds and is of interest to many animal nutritionists. As mature seeds and their products do not represent the sole source of animal feeds the distribution of phytin phosphorus in other plant parts is of great importance. The influence of crop management and stage of maturity on the amount and distribution of phytin phosphorus in different plants and plant parts is worthy of consideration.

The history of phytin investigations is clouded with inconsistencies, conflicting data, and differing theories. No firm agreement has been reached with respect to the complete structural formula of phytin. Methods of determination are indirect and involve many widely different procedures. Recent chromatographic investigations have shown the existence of the lower inositol phosphates in plants. These probably act much like phytin, the inositol hexaphosphate, but are not considered to be phytin. Some methods of analysis measure these lower inositol phosphates with the phytin while some do not adding further confusion with respect to its identity.

These investigations concern the phytin content of plants and were conducted to compare three existing methods of analysis, survey the phytin content of eight crop species; to determine variability in different parts of the plant and observe effects of crop management on phytin content.

These aims were accomplished by studying various plants and plant parts at different stages of development, from germination to maturity, and at varying levels of soil fertility. Investigations early in this study led to further studies on the procedures for phytin hydrolysis and the subsequent measure of inorganic phosphorus.

The results of these investigations follow:

1. All of the employed methods of phytin analysis were reproducible but were clearly not equally accurate. A comparison of two methods of analysis for inorganic phosphorus showed that differences in phytin content may not all be due to the separation of phytin from other phosphates but may be the result of inorganic and total phosphorus determinations after the separation has been made.
2. Species and varieties showed a range in their phytin phosphorus content indicating an inherent potential for the production of phytin.
3. High levels of soil fertility, especially phosphorus and potassium, decreased phytin production in all but one species.
4. Considering the plant in its entirety, phytin concentrations were greater in the young and mature plants than during intermediate stages of growth. Lowest limits were observed at the pre-heading stage in sorghums and early flowering stage in soybeans.
5. Leaves and inflorescences contained the greatest amounts of phytin phosphorus. Roots, leaf sheaths, internodes, and soybean petioles contained little or no phytin phosphorus.
6. Germination increased the inorganic phosphorus content of seeds, but analyses did not show that this was necessarily the result of the hydrolysis of phytin. The increase in inorganic P may have been the result of the hydrolysis of the lower inositol phosphates which are not considered to be phytin.

Microfilm $2.00; Xerox $5.20. 103 pages.

FACTORS AFFECTING SEED SET WITH RESTRICTED POLLINATION IN CORN ZEA MAYS, L.

(L. C. Card No. Mic 59-3588)

McKinley Mayes, Ph.D.
Rutgers University, 1959

Major Professors: Dr. Robert S. Snell
Dr. John C. Anderson

Corn breeders spend much of their time making hand pollinations. Some breeders bag tassels and cut silks the day before the time of pollination, others collect pollen and cut silks at the time of pollination. Because of the time and labor involved in this operation, the most efficient method which will yield the maximum uncontaminated seed set should be employed.

The immediate objective of this investigation was to compare the seed set obtained by a number of pollination treatments. The experiments were designed to supply information on the following:

1. Tassel bagging versus non-tassel bagging as methods of collecting pollen.
2. Effect of different silk cutting methods.
3. Duration of silk receptiveness to pollen.
4. Effect of pollinations made at different times of day on seed set.
5. Effect of temperature and relative humidity on seed set.
6. Effect of soil moisture deficit on seed set.

Many of the field corn and sweet corn inbreds used in the New Jersey breeding programs were included in these

investigations. The field corn was analyzed according to maturity groups.

Sweet Corn

Comparisons for 1958 showed inbreds P39 and C13 to be superior to J243y as a pollen parent. As a seed parent J243y produced more seed than C13 and P39.

Treatments comparing tassel bagging versus non-tassel bagging as pollen collecting methods revealed no real differences in the seed set obtained. No differences were observed between silks cut to one-half inch brush the day before pollination and silks cut to one-half brush at the time of pollination. However, silks cut back to a tight husk set seed significantly less than either silks cut to one-half inch brush the day before pollination or silks cut to one-half inch brush at pollination. Silks pollinated when three days old set seed significantly better than 7-day-old silks. No distinct advantage or disadvantage in seed production was found between pollinations made during morning hours or evening hours.

No effect on seed set was indicated in this study from differences in temperature and/or relative humidity, although, the temperature was usually four to ten degrees higher under the tassel bag than in the open.

Inbreds grown under mild drouth conditions showed no real differences in seed set when compared with inbreds grown under irrigation.

Field Corn

In the early maturity group, B42's better performance over J48 was the only significant difference indicated for pollen parents. As a seed parent J48 set more seed than Oh51A and B42. No inbred in the mid-season group showed any real superiority as a pollen parent. Oh45 was superior to W22 as a seed parent. Hy2's performance as a pollen parent was better than C103, 38-11, and J47 for the late season corn. However, as a seed parent Hy2 produced significantly less than the other three inbreds.

Uncut silks gave better seed set than silks cut back to the tip of the cob, or silks cut back to a one-half inch brush in the early season corn. The mid-season corn indicated differences only between uncut silks and silks cut to cob. Pollinations on 3-day-old silks set seed better than 7-day-old silks in the late season corn. Pollinations made at 11:00 a.m. and 7:00 p.m. produced comparable amounts of seed. Tassel bagging and non-tassel bagging as pollen collecting methods were approximately equal in the seed set obtained.

No differences in seed set could be attributed to differences in temperature and/or relative humidity.

Microfilm $2.00; Xerox $5.00. 98 pages.

SPINACH NUTRITION IN RELATION TO MANGANESE, PHOSPHORUS, AND LIME FERTILIZATION.

(L. C. Card No. Mic 59-3602)

Charles Henry Sparkes, Ph.D.
Rutgers University, 1959

Major Professor: Dr. Stuart B. LeCompte, Jr.

. A series of manganese studies was undertaken in the greenhouse and field to test the interaction of manganese, phosphorus, and lime fertilization on the growth of spinach, and to relate any association of crop response to the total radiant energy received.

Two factorial experiments were performed in greenhouse pot cultures with a market garden soil low in available manganese. Spinach plants were grown with two levels each of manganese, phosphorus, and lime arranged in eight treatments in four replicates of a randomized block design. There were no significant effects from interactions among these three variables on the manganese and iron content of plant tissue or on the fresh and dry weight per plant. A combination of low soil manganese and high lime additions to the soil lowered the manganese content of the spinach plant tops from 150 to 30 ppm, a concentration which borders on the deficiency level. The manganese content of the plant tissue was approximately doubled when this soil was supplemented with eighteen pounds per acre of manganese from manganese sulfate, and decreased by about forty ppm when 700 pounds per acre of hydrated lime were added to the soil. This amount of lime raised the pH of the soil from 5.1 to 6.5. A significant increase in the iron content of the spinach tissue and in the fresh and dry weight per plant was found with higher phosphorus application in one experiment, but not when the study was repeated. The means of all the main effects, whether statistically different or not, were consistent in direction for a given treatment in both experiments.

In the field, a series of three factorial experiments was made on a productive sandy loam soil where spinach was grown for forty-three days. The interaction of two levels each of lime and phosphorus with each of three manganese treatments was tested on the manganese and iron content and the dry weight of spinach tissue. These latter results appeared to be directly related to the total radiant energy received. The manganese content of plants receiving approximately three pounds per acre of manganese sulfate in an aqueous spray was two to three times the content where seventy-five pounds per acre of the compound had been applied to the soil. Differences in manganese in plant foliage, comparing untreated check plots with those receiving soil applications, were found to vary from twenty to thirty ppm over a pH range of 6.3 to 7.3. No relation was found between the dry weight per plant and any of the fertilizer treatments.

Microfilm $2.00; Xerox $3.80. 66 pages.

SEEDLING GROWTH STUDIES OF EARLY-RIPENING PEACHES.

(L. C. Card No. Mic 59-3609)

Gerald MacKnight Weaver, Ph.D.
Rutgers University, 1959

Major Professor: Dr. L. Fredric Hough

These studies were initiated to determine the physiology of the growth regulator complex in peach embryos at different stages of development and the effect of low dosage thermal neutron and X-irradiation treatments on the germination and subsequent growth of embryos harvested at these different stages of development.

Germination of excised Raritan Rose embryos, harvested 75, 83, 91, 99, and at maturity, 107 days from bloom, varied considerably with the stage of embryo development. The data, which were collected following culture on artificial media and eight weeks cold treatment at 4°C., failed to demonstrate any correlation between the initial responses of shoots and seedling survival. Root growth of 83 day embryos far exceeded that of all other stages of maturity. This was reflected in maximum seedling survival and vigor. Initial shoot growth was greatest from embryos harvested at 91 days and at maturity (107 days) but all shoots develop into rosettes which may expand slightly or develop normally from axillary buds.

Bioassays of growth substances suggest a strong correlation between early shoot development and auxin concentration. Root growth responses appeared to be correlated with a promotor-inhibitor balance. The results of wheat coleoptile assay suggest the presence of three growth promotors, in greatest concentration at Rf 0.70, but also at Rf values 0.10 and 0.30. Two growth inhibitors were present in embryo tissue at Rf values 0.27 and 0.96, the former decreasing in concentration with increasing embryo maturity.

Low thermal neutron and X ray treatments were applied following cold treatment to cultured embryos of Raritan Rose harvested at these five stages of development and to embryos of several early-ripening peach selections of a Jerseyland x Mayflower progeny.

Root growth of Raritan Rose embryos harvested 83, and to a lesser extent, 99 days from bloom, was stimulated by thermal neutron exposure. This response was also observed in embryos of the early-ripening selections which were harvested at a developmental stage comparable to the 83 day harvest of Raritan Rose. In addition, shoot growth of these same selections was enhanced following low level thermal neutron dosages. There was little evidence of growth inhibition following the thermal neutron treatments. X ray treatments, on the other hand, induced no significant growth stimuli. Instead, growth inhibition was marked, the intensity increasing with the dosage.

Microfilm $2.00; Xerox $3.80. 66 pages.

SOME PHYSIOLOGICAL AND EMBRYOLOGICAL ASPECTS OF IMMATURE PEACH EMBRYOS.

(L. C. Card No. Mic 59-3614)

Stanislaw Wojciech Zagaja, Ph.D.
Rutgers University, 1959

Major Professor: Dr. L. Fredric Hough

This study was divided into two parts. The first part was concerned with the time relationship between fruit ripening and embryo abortion of the early-ripening peaches, and also with the after-ripening requirements of immature peach embryos cultured on nutrient agar. The second part was concerned with the amino acid composition of peach embryos of varieties ripening early or late in the season. The effect of stratification on amino acid composition of these embryos was also studied.

The experiments provided evidence to show that fruit ripening of early-ripening peaches is followed by embryo abortion.

Immature peach embryos were found to possess after-ripening requirements similar to those of most mature peach seeds.

Stratification decreased contamination in the cultures, improved germination and improved growth of immature embryos. This treatment was also necessary for the production of normal seedlings. Of the number of stratification treatments tried, the best results were obtained when the cultured embryos were stratified for one month at 5°C followed by four months at 1°C.

In the second part of this study 16 amino acids were identified in acid hydrolysates of peach embryos. The number of amino acids detected in the embryos of the very early-ripening peaches was less than in later ripening ones. Samples taken early in the season showed fewer amino acids than samples taken later, whether or not fruits were ripe.

For the early-harvested samples the number of amino acids detected was greater in stratified embryos than in corresponding freshly harvested samples.

Considerable growth and accumulation of dry matter occurred in the cotyledons of the embryos during stratification. From that it was concluded that embryonic growth takes place in immature peach embryos during stratification.

Microfilm $2.00; Xerox $3.80. 68 pages.

REGIONAL LYMPH NODE RESPONSE TO HOMOLOGOUS AND HETEROLOGOUS TRANSPLANTS OF TUMORS AND NORMAL TISSUES IN THE CHEEK POUCH OF THE HAMSTER.

(L. C. Card No. Mic 59-3652)

David Shepro, Ph.D.
Boston University Graduate School, 1959

Major Professor: Donald I. Patt

The golden hamster, Mesocricetus auratus, frequently accepts not only homografts but even heterografts of normal and malignant tissues. One of the many theories attempting an explanation of this phenomenon, namely that lymphatic tissues that drain the sites of implantation do not respond in a typical fashion, motivated this study. Hence, the weight changes and the cytological variations of the superficial cervical nodes in response to homologous and heterologous normal and malignant tissue transplants in the cheek pouch of the hamster were studied.

The major objectives were: (1) to determine if there be any defect in the hamster's lymphatic tissue response to the various transplants; (2) to investigate the effects of the grafts on the large lymphoid cells of the cortex and on the plasma cells of the medulla; and (3) to investigate the feasibility of employing the histological picture of a regional node draining the site of a tumor heterotransplant as a base line for anti-tumor studies during cortisone conditioning.

Experimental Procedure

Adult hamster muscle, human muscle, spontaneous hamster amelanoma melanoma, and human amelanoma melanoma were transplanted into the left cheek pouch of hamsters by means of a #18 trochar. The tissue transplant experiments, with the exception of the homologous tumor, were each divided into two groups; those receiving cortisone acetate and those that were non-cortisone conditioned. In addition, a detailed description of the normal histology of the hamster's lymphatic tissue and two control experiments was made. The controls were run in order to determine the responses of the cervical nodes to cortisone conditioning and to the implantation of a chemically inert substance, a cellulose sponge.

The superficial cervical nodes were removed at autopsy, weighed and fixed in Carnoy's fluid. The fixed tissues were sectioned (5 micra) and stained with methyl-green-pyronine. The histological evaluation of the response was based upon a general description of the nodes and upon a series of counts that calculated the changes in (1) the number of secondary centers in the cortex; (2) the number of large lymphoid cells to small lymphocytes in the cortex; and (3) the proportional numbers of medullary lymphocytes (small, medium and large), plasma cells, reticular cells, granulocytes and mitotic cells.

Observations and Conclusions

a. The histology of the superficial cervical nodes of the hamster is similar to comparable nodes of other laboratory animals.

b. The superficial cervical node is the principal draining node of the hamster cheek pouch but not the only one.

c. Transplanted, adult, normal muscular tissues do not induce a specific response in the regional nodes of conditioned or nonconditioned hosts.

d. Tumor heterotransplants in nonconditioned hamsters evoke a regional node response for approximately eight days, during which time there is a slight increase in the weights of the regional nodes and a slight increase in the number of secondary centers, large lymphoid cells, and plasma cells.

e. Cortisone conditioning inhibits any alteration of the regional lymph nodes that might be induced by a successfully growing tumor heterotransplant.

f. Following tumor homotransplantation, the regional nodes respond unequivocally and the observed histological changes may be described as a typical histo-immunological response. Thus it is concluded that there is no defect in the ability of the hamster's lymphatic tissue to respond to homotransplantation stimulation.

g. It is suggested that both the large lymphoid cell and the plasma cell are involved in the immunological response of the regional node draining either a homo- or heterograft of malignant tissue in the hamster cheek pouch.

Microfilm $2.00; Xerox $5.80. 120 pages.

CYTOLOGY OF THE HYPOPHYSIS IN THE SHAM-OPERATED AND ADRENALECTOMIZED GOLDEN HAMSTER (MESOCRICETUS AURATUS).

(L. C. Card No. Mic 59-3962)

John Roland Thompson, Ph.D.
University of Michigan, 1959

A cytological study was made of the hypophysis of the sham-operated and bilaterally adrenalectomized golden hamster (Mesocricetus auratus), ninety-six animals being used. Since the cytophysiology of the rat hypophysis has been investigated so thoroughly, an attempt was made to correlate the cell types of the rat with those of the hamster. The following staining procedures were used: Masson, aldehyde fuchsin with and without prior oxidation, periodic acid-Schiff and methylene blue, Bodian's protargol

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

and Baker's acid hematein method for phospholipid. Differential cell counts were made after aldehyde fuchsin-Masson staining.

Alpha, beta, $delta_1$ and $delta_2$ and chromophobic cells were identified in the pars distalis. Beta cells were evenly distributed throughout the pars distalis.

The pars distalis of the hypophysis in the hamster and rat differed in morphology, distribution, and relative numbers of the various cell types. The differences between the beta cells of the two species of rodents indicate that it is unwise to assign a definite physiological significance to staining with aldehyde fuchsin. Intercellular colloid was found more frequently in the hamster. The controversial "chromophobic spaces" in the hamster appeared to arise from liquefaction of parenchymal cells beginning with chromophobes and $delta_1$ cells. The inferior portion of the pars tuberalis consisted chiefly of PAS staining cells. The pars nervosa contained much neurosecretory material which was aggregated around sinusoids.

Adrenalectomy of the male hamster caused a decrease in size and number of alpha cells, a moderate degranulation and reduction in size of beta cells, a striking increase in size of $delta_1$ cells, and a small increase in relative number of chromophobes. In the female one or two large homogeneous fuchsinophilic bodies appeared within the nuclei of many alpha cells. Neurosecretory material was depleted from the pars nervosa.

Microfilm $2.00; Xerox $3.00. 56 pages.

ANTHROPOLOGY

A COMPARATIVE STUDY OF WOMEN GRANTED DOCTORAL DEGREES FROM THE NEW YORK UNIVERSITY SCHOOL OF EDUCATION AND WOMEN IN GENERAL WITH PH.D. AND ED.D. DEGREES.

(L. C. Card No. Mic 58-1984)

Rita Anne Burdett, Ph.D.
New York University, 1958

Chairman: Professor Ethel L. Alpenfels

Purpose

The purpose of this investigation was to determine the status of women who have been granted the Ph.D. or Ed.D. degree from the New York University School of Education from 1931 to 1955 inclusive and to compare the trends revealed with a selected list of trends in the status of women with Ph.D.'s and Ed.D.'s in our American society.

Procedure

The comparative data basic to the study could only be secured by direct contact with the personnel involved, and a questionnaire was decided upon as the most appropriate instrument.

A census sample of women who earned degrees from N.Y.U. School of Education and a selective National sample derived from ten universities were used. Both samples were highly representative.

The purpose of this investigation was not only to determine status but ultimately to interpret trends from the accumulated data. Since both bodies of information were original data, they were presented separately and deliberately in parallel form for purposes of comparison.

The summaries were compared and trends derived and interpreted. A high correlation between the findings in the two portions of the study made the presentation of combined trends possible.

Results

These are the most important findings.

More women are earning doctorates and the average time spent in study is from four to five years. Women are on the average thirty-two to forty when the degree is awarded; they have a tendency to study in "women's areas." N.Y.U. graduates tend to study in two areas of interest and the National sample graduates in one.

Most of the women are employed full time and in educational positions in colleges and universities. Women in non-academic positions are more likely to be married than those in educational positions. The salary range is from $6000 to $7000 for the college and university women and from $7000 to $8000 for women in other educational institutions and in non-academic positions.

Most women tend to have from four to five positions during professional life, but settle into one after the degree has been earned. The National group tends to be a little more mobile than the N.Y.U.

Personal satisfaction and professional growth are the motivating factors for earning the doctorate. The N.Y.U. sample realized prestige and salary increase from the earning of the degree as compared to better positions and prestige in the National sample.

Two-thirds of the National sample received financial assistance while studying; most of the women in the N.Y.U. sample did not. Productivity, as judged by publications, increases in direct relationship to how long the degree has been held.

Women graduates are almost exclusively white, Protestant and American-born with mixed European backgrounds. Approximately one-third of the fathers and half as many of the mothers had college educations.

Slightly more than one-third of the graduates are married and the majority married before earning the degree. The husbands of the women in the National sample tend to have slightly higher education comparatively than the husbands of the women in the N.Y.U. sample, but the level of education is relatively high in both. More than half of the husbands are in professions, and a representative number earn more money than their wives.

The marriages in the National sample tend increasingly to be childless, but the average is one and one-half children

per marriage; the marriages in the N.Y.U. sample tend increasingly not to be childless, and the average is one child per marriage.

About one-half of N.Y.U. graduates are financially responsible for dependent relatives and about one-third in the National sample.

The amount of community service is extensive and impressive. These women often take roles much more responsible than membership involvement implies.

Microfilm $4.85; Xerox $16.20. 380 pages.

CULTURAL PERSISTENCE IN A TRINIDAD EAST INDIAN COMMUNITY.

(L. C. Card No. Mic 59-4073)

Morton Klass, Ph.D.
Columbia University, 1959

Beginning in 1845, indentured laborers were brought from India to replace the emancipated slaves on the sugar plantations of Trinidad. Some of these "East Indians" returned home after completing their indentures, but many settled permanently in Trinidad. This dissertation derives from a study made during 1957-58 of an East Indian village in Trinidad. The present adults represent the third generation since the establishment of the village by men newly out of their indentures.

The founders of the village derived for the most part from the north Indian provinces adjacent to the port of Calcutta, but they were from many different and widely separated communities. Thirty-nine castes are represented in the village today. The village they founded, moreover, had to exist within the Trinidad socio-cultural system. Indian cultural forms have persisted, however, and the present community--despite considerable modification--exhibits a social structure that is Indian rather than West Indian. The dissertation concentrates on five structural elements of diagnostic significance: caste relationships, kinship relationships, the life cycle, the religious cycle and authority relationships. These elements are examined in the course of a comprehensive analysis of life in this highly integrated community.

The majority of the villagers are landless unskilled cane-laborers who are dependent upon the large sugar estates for employment. There is a small elite group of comparatively wealthy land-holders or small farmers, from whom the bulk of the village population rents small portions of land for the cultivation of rice. The village elite also includes field-gang foremen and shopkeepers; in other words, all those who control access to jobs, rice-land and food (on credit). The village contains a number of distinct internal districts, and a polarization may be observed whereby the "best" district contains most of the "best" homes and the wealthiest families, and is inhabited by members of the highest castes. There is a rough but definite correlation between caste membership and wealth, and caste is a significant factor in community stratification.

A villager's first obligation is to his family, his second to his circle of kindred and his third to his fictive village kin. Marriage is kin and village exogamous, and still largely caste endogamous. Respectability in marriage is derived from paternal approval, with legal registration considered irrelevant, and most marriages are arranged. East Indian marriages are also normally patrilocal, with the bride assuming the full burden of housework in the home of her husband's parents. Marriage is the most important life crisis, involving community participation and requiring financial assistance.

Almost all villagers are Hindus and participate in a yearly cycle of festivals. Although congregational worship recently has been introduced, most religious ceremonies are performed within the home. There are caste differences in religious practices and socially ranked types of ceremonies. While religion in the village is undergoing certain changes, Indian forms still predominate.

Disputes in the village are usually settled by "big men" who draw a large measure of their authority from occupying the superordinate positions in praja (obligation) relationships. The village elite constitute the most important and influential of these "big men" and direct the political behavior of their many praja subordinates.

Despite the difficulties faced by the founders of the village, they managed to reconstitute a community reflecting their society of origin. The Indian culture was transmitted generationally and has persisted. The village is a highly integrated one--an unusual phenomenon for a Caribbean plantation community--and is structurally similar to the communities of north India.

Microfilm $4.90; Xerox $16.40. 384 pages.

THE MAZAHUA OF THE CABECERA DE LOS INDIGENES: AN EXAMPLE OF NUCLEAR SOCIAL STRUCTURE.

(L. C. Card No. Mic 59-4025)

Barbara Harris Mickey, Ph.D.
Indiana University, 1959

The purpose of the field work herein reported was to study bilaterality and to isolate its features by using first-hand observations of behavior patterns in the Mazahua village under consideration. As the work progressed, however, it became more and more apparent that the bilateral aspects are as weakly developed as the patrilineal--although both do indeed occur--and that the social structure ought not to be classified as either.

Field data--collected through census and interview techniques and first-hand observation--on residence and settlement patterns, land distribution and inheritance, courtship and marriage, the family, daily life, the life cycle, descent and kin grouping, and the compadrazgo is analyzed in terms of behavioral relationships to demonstrate the weakness of the kin organization and the strength of the nuclear family unit.

The social relationships of the Mazahua of the Cabecera de los Indigenes are for the most part circumscribed at the outside by the village. Kinship plays only a slight role in the major phases of social organization. Non-kinship features of bilaterality are evidenced in a fairly strict division of labor, and property ownership by both sexes. Descent of property is bilateral. These factors are offset by a strong tradition of masculine control. Patterns of descent and kin grouping are of secondary structural importance.

Of first importance is the marriage relationship of husband and wife and the nuclear family unit. The nuclear family group is essentially self-sufficient, and customarily represents a clean break in the responsibilities of either member to his parents. Marriage, which occurs at an early age, produces the only significant status shift in the life of the average individual. Although there is no stated rule of village endogamy, most marriages are between two Mazahua of the Cabecera.

The Mazahua comes in contact with three unformalized groups of individuals: (1) his parents and nuclear family; (2) his padrinos; and (3) a group of neighbors, friends, and village mates from which group he will select his wife. For the most part his relatives are as such not more important than any other members of this third group. His selection of associates from the third group is unhampered by prescribed rules.

The concepts involved in bilateral classifications are examined and a preliminary statement is made of a non-kin oriented structure--here called a nuclear structure to point up its emphasis on the husband-wife relationship and the primary family unit. Several cultures which have been shown to be truly bilateral are contrasted to indicate that the nuclear structure differs considerably and should not be termed bilateral simply because it is non-unilateral.

Microfilm $2.00; Xerox $6.00. 122 pages.

THE ARCHAEOLOGY OF NUKU HIVA, MARQUESAS ISLANDS, FRENCH POLYNESIA.

(L. C. Card No. Mic 59-4093)

Robert Carl Suggs, Ph.D.
Columbia University, 1959

A. Methodology

In Polynesian anthropology in the past, there has been an implicit framework into which the results of studies in any of the sub-disciplines have been fitted. The Marquesan data, however, have not been interpreted in terms of such a pre-existing framework but in their own terms alone. The resulting synthesis is internally consistent, but more or less at variance with studies in the previously accepted framework. This variance should be no cause of alarm, however, since interpretation can never be a matter of black or white. Reinterpretation of these same data may result in more agreement than is now apparent between the present work and other studies.

A main characteristic of the interpretational framework, commonly used in the past, was a presupposition of successive migrations as a cause of all major culture change. The Marquesan work provided an opportunity to test the validity of this assumption in terms of one well-ordered body of data. When the data was matched against a set of rigorous criteria generally employed in the New World as standards for detecting migrations, it was found that no evidence exists of any successive migrations to the Marquesas. It is suggested that use of these rigorous criteria for migrational hypotheses in other areas of Polynesia will produce a somewhat different picture of the settlement and development of island societies and a more realistic view of Polynesian navigation techniques.

Several absolute dating techniques have been examined and radiocarbon dating is the most useful at present, if samples are collected with due attention to the geological and cultural peculiarities of the region. The usefulness of lexicostatistical dating is impaired at present due to a lack of dependable data and controls for relatively short range dating such as is employed. Traditional dating is found to be of very limited use.

Historical typological concepts, and survey and seriation procedures used in the New World have been found to yield promising results in the study of Polynesian archaeological remains.

The utility of various artifact types for relative dating has been tested and it is evident that aesthetically pleasing artifacts, such as stone adzes or personal ornaments are not always the only or even the best chronological indices. Attention should be directed in future work to the more banal artifacts which may be surprisingly useful for relative dating.

In comparison of archaeological material from various areas of Polynesia, caution should be used, for the present, in utilizing pan-Polynesian typologies and terminology. Such typologies may often obscure features of a minute, but nonetheless historically significant nature. Each major island group should be worked out in terms of its own sequences first and only then can pan-Polynesian typologies be developed. For the present, comparisons will not be unhindered in the absence of such universal classifications.

B. Culture History

The Marquesas were settled by a Polynesian group already well-adjusted to existence on a tropical high Polynesian island. The culture therefore required an absolute minimum of readjustment to integrate with the various special aspects of Marquesan environment. Subsequent cultural development was a result of the realization of the inherent possibilities of the settling culture, within the framework of their new environment, free from modifying exotic cultural influences. The dynamic of this development was an economy based on breadfruit, wet taro, and other starchy staples. With increases in production efficiency and in population, constantly larger surpluses were produced. The surplus was appropriated and redistributed by a ramage type organization in a prestige rivalry situation of increasing momentum, culminating in a cultural and social florescence in the Classic Period. The florescence was achieved against a background of intergroup warfare of mounting violence as the population expanded to the point of saturation of arable land.

Microfilm $6.25; Xerox $21.60. 490 pages.

INCREASED SURVIVAL OF IRRADIATED MICE TREATED WITH MICROBIAL ANTIGENS.

(L. C. Card No. Mic 59-4323)

Earl John Ainsworth, Jr., Ph.D.
Brown University, 1959

Irradiation mortality is decreased in animals receiving intravenous injections of various types of antigens from Gram-negative bacteria or zymosan. Gram-positive antigens are ineffective in this respect. The extent of this protective effect depends upon the time of antigen injection relative to irradiation, the amount of antigen given, and the irradiation dose. Mortality is decreased at 600r if animals are injected with 3 γ of endotoxin between 48 hours before and 24 hours following irradiation. As the irradiation dose increases, however, the range in time of effective treatment, as well as the extent of mortality reduction, are reduced. At 700r post-irradiation treatment is wholly ineffective and treatment before irradiation less effective than at 600r. Mortality is decreased at 750r only by treatment 24 hours before irradiation, but this treatment fails to decrease mortality at 800r or 900r; survival time, however, is increased at 800r.

Endotoxin-treated mice show an increased resistance to endogenous infection as evidenced by decreased numbers of positive organ (spleen, liver, lymph node) and blood cultures. The mechanism of endotoxin-protection may involve increased properdin levels, increased activity of the reticulo-endothelial system, and an accelerated rate of hematopoietic recovery.

Microfilm $2.00; Xerox $3.00. 38 pages.

CONTINUOUS ANTIBIOTIC FERMENTATION. THEORY, DESIGN OF A SINGLE-STAGE PILOT PLANT, AND TRIALS WITH TWO CONTRASTING PROCESSES.

(L. C. Card No. Mic 59-3910)

Morton Covell Bartlett, Ph.D.
University of Michigan, 1959

Industrial use of continuous fermentation has been restricted almost entirely to processes that yield bulk products and depend for their advantageous operation on a highly restrictive growth situation. However, an application of considerable economic and medical interest would be antibiotic production. Because the published literature carried very little indication of progress in this area, a small pilot plant was designed and assembled and a study of single-stage continuous antibiotic fermentations was conducted. Chloramphenicol and penicillin were employed because they represent biologically contrasting types of fermentation and therefore provided a test of the feasibility of continuous antibiotic fermentation.

A historical review was made of the literature pertaining to continuous fermentation in research and industry, the latter especially in antibiotic fermentations. A bibliography of more than 450 references relative to these and closely related topics was compiled.

The theoretical considerations of continuous fermentation were reviewed, mathematically developed, and analyzed in some detail as they have been sufficiently well advanced to provide a good foundation for experimental studies. A table correlating and standardizing the terms and symbols used by various authors was prepared.

The 20-liter pilot plant was designed to be as simple as possible and potentially capable of being scaled-up to existing production equipment. Features of the assembly included the use of needles and rubber diaphragms for feed lines and sampling, an air-product effluent pipe to maintain the liquid level in the fermenter, a back-pressure regulating valve and entrainment separator on the effluent system, alternately sterilizable air filters, and heat seals to control back growth of contaminants. The medium was transferred by air pressure from a batch sterilizer to a magnetically-stirred, sterile hold tank and from there was continuously metered by a peristaltic-action pump into the aerated and agitated fermenter; the crude product simultaneously was air lifted from the fermenter, separated, and collected.

After successful sterility and batch-fermentation trials, the system was first tested in producing chloramphenicol. In tests with a dilution rate of 1.0 volume change per day, the continuous fermentation showed an initial drop from the higher batch antibiotic yield and then allowed maintenance of 75 to 125 μg per ml of chloramphenicol, about one quarter of the maximum batch yield. Lower feed rates of 0.5 and particularly 0.25 volume changes unexpectedly and unexplainably seemed to lower the yield, although the pH and solids were relatively unaffected. Experiments were conducted which indicated that this lower yield was not attributable to strain degeneration.

Following these tests, continuous penicillin fermentations were also conducted. Tests with a dilution rate of 1.0 volume change per day washed out the penicillin within 4-1/2 days. At dilution rates of 0.5 volume change per day, penicillin yield levels of 1000 units per ml were maintained except when operational variables had an adverse effect. Substitution of glucose for lactose in the feed medium adversely affected yields.

Both of the continuous fermentations were maintained for periods up to 17 days. However, contamination with extraneous microorganisms was common in the trials and represented the most important limiting factor to the success of continuous operations. In addition, during penicillin fermentations, the accumulation of mycelium inside the fermenter and within pipes and valves appeared to be an inherent and ultimate limitation of the continuous fermentation.

Production estimates on a daily production basis indicated that the chloramphenicol batch and continuous operations were roughly comparable while the penicillin

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

continuous fermentations were up to twice as productive as the batch operation.

It was concluded that single-stage antibiotic fermentations are feasible and that further development could improve their efficiency.

Microfilm $2.75; Xerox $9.60. 212 pages.

SOME CYTOLOGICAL, HISTOCHEMICAL, AND NUTRITIONAL STUDIES WITH MEMBERS OF GENUS VEILLONELLA.

(L. C. Card No. Mic 59-3836)

Benjamin John Cosenza, Ph.D.
The University of Connecticut, 1959

The genus Veillonella, consists of gram negative anaerobic micrococci inhabitants of the buccal cavity, colon, and genital tract of man; some strains have been associated with disease, but their role in medical bacteriology is controversial. Revived interest in this group stems from a recent report in the literature citing these as incitants of dental caries.

A study was undertaken to investigate the cytology (nuclear apparatus, and a comparative biochemical study of cell wall) and some nutritional requirements of these organisms, in order to gain additional information which may aid in clarifying their taxonomic position.

A collection of 15 cultures was assembled, by isolation and from culture collections. Pure culture studies showed that the laboratory isolates and reference strains were similar in most details to the descriptions in Bergey's manual. Of these, 4 were selected for most studies because of differences in size, difference in nutritional needs (as assessed by growth in several complex media) and ease of culture: a laboratory isolate designated as V-28, Micrococcus lactilyticus T-12, Veillonella parvula (ATCC 10790) and Veillonella alcalescens (ATCC 12641).

Cytology concerned several procedures for staining nuclear structures including variations in (1) fixation (Bouin's fluid, Carnoy's fluid, 95 per cent ethyl alcohol and OsO_4 vapor); (2) removal of cytoplasmic basophilia (ribonuclease, hydrolysis in N HCl at 60 C); and (3) in staining (Giemsa, Feulgen, and crystal violet). In all strains studied, with the most favorable nuclear preparations, it was possible to demonstrate stainable resisting hydrolysis or removal by ribonuclease. The relative large size and convenient growth characteristics of M. lactilyticus afforded ready demonstration of cell wall in addition to nucleus. Although suitable preparations were made with the other 3 strains, photomicrography failed to accentuate equally clearly the cell boundary which may be attributed to their minuteness.

The putative cell wall of the 4 strains selected, was collected by centrifugation, was exhaustively washed and finally lyophilized. The lyophilized material was subjected to hydrolysis at 105 C (20 hr in 6 N HCl for amino acid recovery and 100 C for 2 hr in N H_2SO_4 or 2 N HCl for sugar). The component amino acids and sugars were identified by paper chromatography. From 10 to 17 ninhydrin-positive substances were found in cell wall hydrolyzates of the 4 strains. In addition diaminopimelic acid (DAP) was identified also by auxanographic technique, using a mutant strain of E. coli obtained from Dr. L. Rhuland. The sugars detected were glucose and galactose. Because of the lack of pentoses in cell wall fragments, attempts were made to improve isolation by alteration of time, temperature, and concentration of acid for hydrolysis. Hydrolysis of whole cells (HCl or H_2SO_4) showed pentose, whereas the cell wall material showed none. The strains showed content of amino acid and DAP similar to other gram negative species.

Nutritional studies were made by the method of replicate transfer and photometric estimation of turbidity. Single compounds were omitted from a complex synthetic medium composed of sodium lactate, 16 to 18 amino acids, vitamins, purines, pyrimidines, trace elements, buffer and sodium thioglycolate. Preliminary findings showed that M. lactilyticus, and V. alcalescens failed to grow in the chemically defined medium if thiamine, pyridoxine·HCl, and calcium pantothenate were omitted. V. parvula failed to grow on any synthetic medium tested. Niacin appeared stimulatory for the 3 strains. The purine and pyrimidine requirements were heterogenous, e.g., V-28 required guanine, with adenine, thymine, and thymidine stimulatory; M. lactilyticus must be supplied with adenine, guanine, xanthine and uracil; and V. alcalescens was stimulated by the addition of guanine, thmidine, and xanthine.

In the study of amino acid requirements V-28 failed to grow when aspartic acid and serine were omitted; alanine, tyrosine, methionine, and threonine appeared to be stimulatory. M. lactilyticus failed to grow in amino acid medium in which riboflavin, biotin, folic acid, p-aminobenzoic acid, vitamin B_{12}, leucovorin, thymidine and thymine had been omitted. V. alcalescens required glycine and serine, with methionine and histidine appearing stimulatory. Microfilm $2.00; Xerox $3.00. 47 pages.

IMMUNOCHEMICAL STUDIES ON CROSS-REACTIONS OF ANTIPNEUMOCOCCAL SERA.

(L. C. Card No. Mic 59-4063)

Joel W. Goodman, Ph.D.
Columbia University, 1959

A variety of dextrans cross-react with Types II, IX, XII and XX antipneumococcal sera and, to the extent of their cross-reactivity, remove the same fraction of anti-SII, anti-SIX, anti-SXII or anti-SXX.

There appears to be no correlation between the proportions of various linkages in the dextrans and the maximum quantity of anti-SII or anti-SXX precipitable by any given dextran. Glycogen precipitates a portion of the anti-SII which cross-reacts with dextrans.

A relationship between the proportions of 1→6 linkages in the dextrans and their ability, on a weight basis, to precipitate cross-reacting anti-SII or anti-SXX was found. In general, dextrans with 70 percent or more α 1→6 linkages are equally efficient in precipitating cross-reacting antibody but precipitating efficiency declines with decreasing proportions of 1→6 linkages below 70 percent. Several dextrans were found which did not follow this relationship.

Quantitative inhibition studies with oligosaccharides show that oligosaccharides of the isomaltose series are

the best inhibitors of the cross-reactions of anti-SII and anti-SXX with dextrans and anti-SII with oyster glycogen. An upper limit in inhibiting power of the cross-reactions of anti-SII and anti-SXX with dextran N236 was reached with isomaltopentaose and isomaltotetraose, respectively, indicating extents of the complementary areas of the cross-reacting combining sites on these antibodies in close agreement to that found in another study for the dextran-human antidextran system. With other dextrans, units as small as α-methylisomaltoside gave maximum inhibition. The cross-reaction of anti-SII with glycogen was inhibited maximally by α-methylisomaltoside.

The cross-reaction of anti-SII with Friedländer Type B polysaccharide seems to involve a fraction of anti-SII independent, at least in part, from the fraction cross-reacting with dextrans; glucuronic acid residues may be involved in the specificity of this cross-reaction.

Dextrans with high proportions of α 1→6 linkages cross-react poorly with anti-SIX while some dextrans with high proportions of α 1→3 like linkages precipitate the largest quantities of antibody N and three dextrans with high proportions of α 1→2 linkages precipitate about 2/3 of this cross-reacting antibody. Inhibition studies of the cross-reaction of anti-SIX with a dextran with 38 percent 1→2 linkages and 12 percent 1→4 linkages (B1299-S-3) show that a trisaccharide, 4-0-α-D-glucopyranosyl-3-0-α-D-glucopyranosyl-D-glucopyranose (T_2), was the best inhibitor tested; maltose, nigerose and kojibiose were the best disaccharide inhibitors of this cross-reaction, all three being poorer than T_2 and about equal to one another. Inhibition studies of the cross-reaction of anti-SIX with a dextran with a high proportion of 1→3 like linkages (B1355-S-4) show that nigerose is a much more effective inhibitor than either maltose or kojibiose and as good, on a molar basis, as either T_2 or 3-0-α-D-glucopyranosyl-4-0-α-D-glucopyranosyl-D-glucopyranose, indicating a heterogeneity in the specificity of the anti-SIX involved in the cross-reactions.

Dextrans with high proportions of 1→2 linkages precipitate the most antibody N from anti-SXII while dextrans with high proportions of 1→6 linkages precipitate the least and kojibiose was found to be the best inhibitor of the cross-reaction of anti-SXII with B1299-S-3. Trehalose was almost as effective as kojibiose in inhibiting the cross-reaction of anti-SXII with B1355-S-4 (no 1→2 linkages), also indicating heterogeneity in the specificity of the cross-reacting fraction of anti-SXII.

The data indicate that N-acetylglucosamine and glucuronic acid may be involved in the specificity of the cross-reacting fraction of anti-SIX and N-acetylglucosamine may be involved in the specificity of the cross-reacting fraction of anti-SXII.

Microfilm $2.00; Xerox $4.40. 84 pages.

THE EFFECT OF CHRYSANTHEMUMMONOCARBOXYLIC ACID UPON RESPIRATORY PATHWAYS.

(L. C. Card No. Mic 59-3585)

Richard Charles Kestenbaum, Ph.D.
Rutgers University, 1959

Major Professors: Dr. J. A. Anderson
Dr. B. W. Koft

dl-trans-Chrysanthemummonocarboxylic acid (CMCA) was found to inhibit a wide variety of microorganisms. Most organisms tested were completely inhibited by concentrations of from 1.2×10^{-2} to 3.1×10^{-2} M CMCA. Streptococcus faecalis R was much less sensitive to this inhibitor, whereas Penicillium notatum was very sensitive. The addition of excess glucose, amino acids, phosphate, the B vitamins and vitamins K_2 and Q_{275} failed to reverse growth inhibition of Bacillus subtilis.

The oxidation of glucose, gluconate, pyruvate, l-alanine and l-glutamate by B. subtilis were all completely inhibited by 2.4×10^{-2} M CMCA. The addition of cystine or cysteine failed to reverse the inhibition of glucose oxidation by this compound. Therefore this compound does not exert a primary action on SH groups or S-S bonds. Concentrations of 3.4×10^{-2} M CMCA did not appreciably effect the enzymes urease, trypsin, catalase or cytochrome oxidase, demonstrating that this compound is not a general protein inactivator.

The anaerobic reduction of methylene blue by the following electron transport systems were all inhibited by CMCA: yeast alcohol dehydrogenase, yeast lactic dehydrogenase, rabbit muscle lactic dehydrogenase, E. coli lactic dehydrogenase, succinic oxidase, glucose oxidase and diaphorase. CMCA also inhibited oxygen uptake in all of the above complete systems except glucose oxidase. The compound also inhibited the reduction of DPN by yeast alcohol dehydrogenase, but not by rabbit muscle lactic dehydrogenase.

High concentrations of methylene blue were capable of mediating the transport of hydrogen from reduced DPN to oxygen in the absence of any enzyme. This reaction was not effected by CMCA.

These results indicate that CMCA exerts a primary action on cellular respiration. Probable sites of inactivation are in the transport of hydrogen from flavo-protein to methylene blue, and in the cytochrome system.

Microfilm $2.00; Xerox $5.20. 101 pages.

HOST-CELL METABOLISM DURING VIRAL SYNTHESIS.

(L. C. Card No. Mic 59-3936)

Philip Choo Seng Loh, Ph.D.
University of Michigan, 1959

An investigation was made of certain biochemical and biological aspects of viral development in cell cultures of human origin (strain HeLa) infected with Type I poliovirus. This study was largely centered on the relationships of nucleic acid and protein synthesis to viral replication.

Part I of the study deals with the response of cells, labeled with radioactive phosphorus (P^{32}), to infection with poliovirus. After a period of several hours, during which the pattern of release of radioactivity follows that of the uninfected control, there occurs a marked transfer of labeled materials from the infected cells into the extracellular fluid. The initiation of this transudation coincides with the first release of virus and with retraction of the cytoplasm. The enhanced release of radioactivity is related to the size of the viral inoculum and is not seen when virus, pre-neutralized with antiviral serum, is used. The observations serve to emphasize the importance of defining the period during which a chemical study of virus synthesis is feasible.

In part II, data are presented from a chemical and isotopic analysis of sub-cellular fractions of HeLa cells at various times during a single sequence of infection. Within one hour after the initiation of infection, there is a detectable accumulation in the cytoplasm of newly synthesized protein and RNA (ribonucleic acid). Also at this time there is an enhanced incorporation of P^{32} by nuclear RNA and DNA (deoxyribonucleic acid) without a net increase in either nuclear nucleic acid. The synthesis of cytoplasmic protein continues at a constant rate until the seventh hour of infection. RNA of the cytoplasm is formed at a constant rate until the fourth hour, at which time the rate is markedly enhanced. The fourth hour is also marked by a sharp decline in the incorporation of P^{32} into both the nuclear RNA and DNA, and the appearance of the first virus, as infectious activity, in the cytoplasm. The accumulation of cytoplasmic RNA ceases at the sixth hour, but virus accumulates at an increasing rate in the cytoplasm from the fourth to the seventh hour, when 99 per cent of the virus formed is present in the intracellular state. From the amounts of nucleic acid and protein produced, their distribution relative to virus among various sub-cellular fractions, and from the nucleotide composition of the RNA, it was concluded that the major portion of the newly formed materials was not virus and at least in the case of the RNA was not destined to be virus. From consideration of these observations, a hypothesis is presented, which suggests that "unbalanced growth" is responsible for cytopathology.

Microfilm $2.00; Xerox $6.00. 124 pages.

STUDIES ON INFECTION OF THE BOVINE MAMMARY GLAND WITH STAPHYLOCOCCI.

(L. C. Card No. Mic 59-3754)

Keith Irving Loken, Ph.D.
University of Minnesota, 1959

A study of bovine udder infections with Staphylococcus aureus was undertaken to determine the extent, clinical characteristics, and epizootiology of the infections and to determine the characteristics of the infecting organisms.

The incidence of S. aureus in milk samples was determined by the examination of 1,476 quarter samples from 38 herds with mastitis problems. It was found that 21.9 per cent of the samples contained S. aureus.

The clinical course of staphylococcic mastitis was determined by observing the natural course of the infection in a large dairy herd and by the examination of experimentally infected cows. Elimination of Streptococcus agalactiae from the herd by treatment did not materially affect the proportion of quarters infected with S. aureus. There appeared to be some interference with the establishment of infections with S. aureus in glands which were shedding non-agalactiae streptococci. Treatment of chronic staphylococcal infections by intramammary or systemic therapy was not effective in controlling the infections.

Most of the cows which became persistent shedders of S. aureus were infected in one or more quarters in their first and second lactation periods. The maximum rate of shedding on a quarter basis was reached in the third lactation period after which it remained quite constant. These findings indicated that there was no increase in susceptibility to infection with advancing age as has been shown for Streptococcus agalactiae. The development of clinical mastitis as determined by the secretion of physically abnormal milk was found to parallel the rate of shedding of S. aureus. No significant seasonal variation in the incidence of clinical mastitis was observed.

The coagulase test with human plasma was found to be an adequate criterion of pathogenicity. It was found that many cultures which would coagulate human plasma would not coagulate bovine plasma presumably due to the lack of coagulase reacting factor in bovine plasma.

The hemolysins produced by 367 strains of coagulase-positive staphylococci was determined by the antitoxin strip method of Elek and Levy. All seven possible combinations of alpha, beta, and delta lysins were observed. A combination of beta and delta lysins was produced by over 60 per cent of the strains. Alpha, beta, and delta lysins were produced by 23 per cent of the strains examined. Since over 97 per cent of the strains examined produced beta hemolysin, this hemolysin would adequately serve as a criterion of potential pathogenicity in routine mastitis control studies.

A series of 514 cultures of staphylococci from 33 dairy herds were subjected to the action of 24 bacteriophages. The strains which were lysed were placed in groups according to the patterns of lysis. Lysis by phage 42D (Group IV) was the most frequent observation. Lysis by phages of Group III was found to be the next most frequent pattern. Twenty-one of twenty-four herds from which typable staphylococci were isolated contained only one typable population of S. aureus. Limited studies suggested that typable strains were frequently more pathogenic than non-typable strains.

The milking machine was implicated as a major factor in the spread of infection.

A survey of the incidence of penicillin resistance in S. aureus isolated from bovine udders revealed that 80 per cent of 365 strains from 30 herds were susceptible to 0.1 unit of crystalline penicillin G per ml. of broth. The majority of the penicillin resistant strains were lysed by phages of Group III. Several penicillinase-producing coagulase-negative micrococci were isolated from milk samples. Attempts to induce penicillin resistance in vivo were not successful.

Microfilm $2.00; Xerox $5.60. 115 pages.

CHEMOTHERAPEUTIC STUDIES WITH VIRUS-INDUCED ROUS SARCOMA.

(L. C. Card No. Mic 59-3593)

Roman Joseph Pienta, Ph.D.
Rutgers University, 1959

It has been shown that tumor cells appeared microscopically in the wing web of chicks within 48 to 72 hours after subcutaneous inoculation with standard Rous sarcoma virus (RSV) and also that the latent period for the production of tumors could be modified by the administration of certain therapeutic agents. In view of these observations, studies were undertaken to develop a test system for the detection of new therapeutic agents and for the evaluation of substances having activity in other systems. The test system consisted of inoculating suitably diluted standard RSV subcutaneously into the wing web of White Leghorn chicks less than 10 days of age. Intramuscular treatment with potential therapeutic substances or substances active in other biological systems was begun 3 days after infection and continued for a total of 5 days. To test for the prophylactic effects of a number of biologically active materials on Rous sarcoma treatment was initiated 2 days prior to infection and was continued for a total of 10 days. The chicks were observed daily for the appearance of tumors and the mean latent period for tumor production was determined graphically by the use of rankits.

When treatment was initiated 3 days after infection with RSV, amethopterin, 6-mercaptopurine, progesterone (male chicks only), testosterone (female chicks only), and triethylenemelamine exhibited slight but detectable activity in delaying the latent period for tumor production. Azaserine, colchicine, and n-methylformamide exhibited questionable activity, and only at toxic dose levels.

When treatment was initiated 2 days prior to infection with RSV, the most marked delay in latent period response was induced by 9α-fluorodeltacortef, 2α-methylhydrocortisone, and prednisolone. The latent period response was also significantly delayed by amethopterin, 8-azaguanine, 1,4-dimethanesulfonyloxybutane, 6-mercaptopurine, mytomycin-C, and triethylenemelamine. Minimal activity was obtained with estrone and 2,6-diaminopurine.

In addition, a search was made to find new substances which would modify the latent period response in chicks infected with RSV. Thus, filtrates and propylene glycol extracts were prepared from a large number of actinomycete and gram-negative bacterial cultures originally isolated from the soil and were tested for their therapeutic activity. Of 63 actinomycete filtrates tested, 4 significantly delayed the latent period response on preliminary test while 4 others showed questionable activity. The extraction of 54 of these cultures with propylene glycol yielded 5 preparations which significantly delayed the latent period and 2 others with questionable activity. When the respective filtrates or extracts were again prepared from 15 cultures which showed activity on the preliminary test and were retested, 2 extracts consistently delayed the latent period response. When the supernates or propylene glycol extracts of 55 cultures of gram-negative bacteria were tested, 3 significantly delayed the latent period ($P<0.01$) in the preliminary test. However, none of these were active on retest. A study of the conditions for growth and the preparation of extracts from the 2 actinomycete cultures active on retest indicated that the time of incubation and the pH of extraction influenced the activity of the resulting extracts. An attempt was also made to increase the potency of the extracts by extracting the mycelia with various organic solvents. Activity was obtained when ethanol, tertiary butanol, and acetone were employed, however, no increase in potency was observed.

The data indicate that the delay in latent period for the production of tumors in the wing web of chicks inoculated subcutaneously with RSV can be used as an index of activity for the detection of potential antitumor agents and for the study of antitumor agents active in other test systems.

Microfilm $2.00; Xerox $5.00. 96 pages.

TRANSFORMATION OF CYSTEIC ACID AND TAURINE BY SOIL MICROORGANISMS.

(L. C. Card No. Mic 59-3604)

Edward Olley Stapley, Ph.D.
Rutgers University, 1959

Major Professor: Dr. Robert L. Starkey

The dissimilation of cysteic acid and taurine has been studied with pure cultures of bacteria and actinomycetes isolated from soil by enrichment technique. Experiments with growing and pregrown cells were conducted at 28°C in shaken flasks of liquid medium composed of inorganic salts with either cysteic acid or taurine as the sole source of carbon, nitrogen and sulfur. The actinomycete (Streptomyces sp.) utilized cysteic acid only, whereas the bacterial isolates (Pseudomonas sp.) were capable of degrading cysteic acid and taurine. Growth of the microorganisms paralleled transformation of the substrates without accumulation of organic intermediates.

Sulfate and ammonia were products of decomposition of both cysteic acid and taurine. The rates of formation of sulfate and ammonia indicated that deamination preceded desulfuration. There was no appreciable change in reaction (pH) with dissimilation of cysteic acid but marked increase in acidity accompanied the degradation of taurine. Whereas sulfite was detected as a product of dissimilation of cysteic acid by the actinomycetes at neutral pH, it only accumulated at distinctly alkaline reactions (pH 8.5 - 9.0) in the case of the bacteria. The breakdown of taurine by bacteria was similar to that of cysteic acid; however, sulfite was not detected as a product.

The degradation of both substrates was adaptive. Whereas the pathways are analogous for breakdown of the two compounds, they are not identical because exposure of cells to either compound did not necessarily result in adaptation to the other. Some evidence was obtained that cysteic acid may be degraded via more than one major pathway. Microfilm $2.00; Xerox $5.40. 107 pages.

CYTOLOGICAL AND CYTOTAXONOMICAL STUDIES IN SPREKELIA, LYCORIS AND SETCREASEA.

(L. C. Card No. Mic 59-4214)

Smritimoy Bose, Ph.D.
University of Virginia, 1959

Part I. A Cytotaxonomical Study of Sprekelia formosissima Herbert

In Sprekelia a chromosome series - apparently euploid - with 2n=60, ca.120, ca.150 and ca.180, respectively, was observed. This same series of numbers was also noticed in the selfed and crossed seedlings. The failure to find a constant number in taxa with ca.120, ca.150 and ca.180 chromosomes has been believed to be associated with polyploidy, complexities of crowding effects of chromosomes and other phenomena. Evidence for the presence of a polyploid series is also seen in the corresponding increase in stomata and pollen sizes of the different chromosome races. The apparently 100 per cent success of a cross between 2n ca.180 and 2n=60 taxa suggests the probable hybrid origin of chromosome races in nature. The karyotypes show four major types of chromosomes in each of the chromosome races in the seedlings of selfed crossed progenies. Different chromosome number races in the polyploid series show a gradual increase in the numbers of all the four types of chromosomes. The cytological as well as morphological data suggest the presence of autopolyploidy rather than allopolyploidy. The basic number here seems to be 30. From this point of view diploid, tetraploid, pentaploid and hexaploid types have been found here, but the possibility of this number (30) having been derived from an original one of 6, has been discussed. Taxonomically, Sprekelia shows closer cytological affinities with genera in tribe Zephyrantheae, than with those of any other group; it thus seems most reasonable from a karyological point of view to include Sprekelia in Zephyrantheae.

Part II. Karyotype Evolution in Lycoris

Of the ten species and chromosome races studied here new numbers of 2n=15, 29+1 B and 30 chromosomes have been counted for L. aurea, L. incarnata and L. houdyshelii, respectively. In L. traubii races with 2n=12 and 13 chromosomes were found while numbers of 2n=22 and 27 occur in L. haywardii and L. caldwellii, respectively. Although the chromosomes can be broadly divided into V and rod-shaped elements, karyotype analyses show five major types of chromosomes and in addition one very short chromosome (B chromosome) has been observed in L. incarnata. Fragmentation of V-shaped chromosomes rather than fusion of rod-shaped ones is suggested to be responsible for karyotype evolution. Accordingly the basic number in Lycoris is believed to be 11 and a primitive type with 11 V-shaped chromosomes, or possibly with 10 V and 2 rod chromosomes, is a suggested taxon giving rise to all other chromosome number types. The fertility and general stability of such a, as now theoretical, 2n=11 form has been considered. Concurrently, the existing 2n=12 form of L. aurea has been discussed as possibly the most primitive Lycoris. Recent theories regarding the origin and stability of telocentric chromosomes, and the role which the centromere plays here, have been considered. Gene mutation, translocation, polyploidy and hybridization are all recognized to have a part in karyotype evolution and speciation. Speciation and chromosome number variation in Lycoris without the addition of extra chromosomal elements has been noted. Apparently little or no correlation has been found between taxonomical and the known karyological data for the several species.

Part III. A Cytological Study of Setcreasea purpurea Boom and of an Aneuploid Taxon of S. brevifolia (Torr.) Rose

In Setcreasea purpurea 12 somatic chromosomes have been observed, while the finding of 2n=25 chromosomes in S. brevifolia suggests the constitution here to be 4n+1. Three major types of chromosomes have been recognized in the karyotypes of both taxa. Meiosis in S. purpurea is regular. Irregular meiotic behaviour in S. brevifolia is connected with aneuploidy and structural hybridity. The presence of pollen grains in S. brevifolia with 25 chromosomes could have been due to the failure of the chromosomes or chromatids to go to different poles, or possibly to a complete failure of cell wall development.

Microfilm $2.10; Xerox $7.40. 157 pages.

THE BEHAVIOR OF HYBRID STERILITY IN AN INTERVARIETAL CROSS OF ORYZA SATIVA L.

(L. C. Card No. Mic 59-3071)

Horace Rouse Caffey, Ph.D.
Louisiana State University, 1959

Supervisor: Professor Merlin T. Henderson

The behavior of fertility in an intervarietal hybrid of Oryza sativa L. was studied by the analysis of two expressions of fertility (percent seed set and percent stainable pollen).

Both parents had a mean seed set and stainable pollen percentage greater than 89.0 percent in 1956 and 1957. There was no coefficient of variation above 9.0 percent for either parent in respect to either seed set or stainable pollen in 1956 or 1957. The majority of the plants of the parent varieties showed seed set and stainable pollen to be above 90.0 percent both years. These results indicated

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

that the small amount of variation among plants within each variety was caused by environmental differences and that both parents could be assumed to be true breeding for high fertility.

The seed set of the one F_1 plant available for this study was 41.5 percent. The mean of 952 F_2 plants in regard to percent seed set was 48.3 percent. The distribution of plants in F_2 showed a continuous range from 0 to 100 percent. The plants could not be classified into distinct and separate groups according to seed set that would permit identification of ratios. Sterility did not behave as a typical qualitative trait. F_2 results also failed to show the behavior of sterility as a typical quantitative trait.

There were five F_3 lines that appeared to be homozygous for normal fertility. There were no partially sterile F_3 lines which bred true for any degree of fertility. Completely fertile segregates occurred in 90 of the 91 F_3 lines studied. This indicated that no plant selection in an intervarietal cross should be discarded because of its low fertility.

The F_3 results of seed setting also did not reveal any evidence that sterility was caused by a genic mechanism. The behavior of sterility in this intervarietal rice cross could be accounted for more readily by structural differentiation of the parental chromosomes.

The correlation coefficient between percent seed set in F_2 and percent seed set of F_3 lines derived from them was 0.59. The regression coefficient was 0.34. This indicated selection would be very effective. Selection for high fertility was not needed, however, since apparently fertile segregates occurred in all but one line.

The pollen stainability studies revealed information almost identical to that determined through seed set studies. However, the F_1 was much less fertile and showed only 4.3 percent stainable pollen. The mean of 866 F_2 plants examined for stainable pollen showed a continuous range from 1.0 to 98.0 percent. The F_3 means showed a continuous distribution from 21.6 to 92.1 percent stainable pollen. Eleven F_3 lines appeared to breed true for normal fertility and the remainder of the F_3 lines contained some plants with very low stainable pollen. None of the lines were found to be true breeding for partial sterility. There were completely fertile plants in 90 of the 91 F_3 lines studied. The F_3 data agreed with the F_2 pollen stainability and with seed setting results. There was no evidence of a genic cause of sterility.

Highly significant correlations of 0.68 and 0.77 between seed set and stainable pollen were found in the F_2 and F_3 generations, respectively. One correlation between fertility as expressed by stainable pollen was found to be correlated with degree of variation in apiculus color. None of the other correlations between the four plant characters and fertility were significant.

This investigation revealed only negative evidence for the sterility being caused by genes, but the results could be accounted for easily by structural differences in the chromosomes. Microfilm $2.00; Xerox $4.80. 91 pages.

ANALYSIS OF GENES CONDITIONING RESISTANCE OF OAT VARIETIES TO RACES OF PUCCINIA CORONATA CDA, VAR. AVENAE F. AND L.

(L. C. Card No. Mic 59-3737)

Te-Tzu Chang, Ph.D.
University of Minnesota, 1959

Recent revision in the system of identifying and numbering physiologic races of Puccinia coronata avenae has affected the applicability of previous information on the inheritance of crown rust resistance which was based on tests with races identified in the old series. Seventy-eight crosses among 14 oat varieties were tested to four races in the new series (203, 216, 258 and 276) to determine the genetic basis of resistance and the allelic relationship among genes for resistance. In certain selected crosses, the F_2's were inoculated in succession to two races to determine the relationship of genes conditioning resistance to different races.

Based on the above studies, the specific gene or genes governing resistance to races of P. coronata avenae in the nine resistant varieties are postulated as follows:

1. Ascencao: Ascencao carried two dominant, independent genes, 'V' and 'E', which singly or jointly controlled resistance to races 203 and 258. The 'V' controlled moderate resistance to race 276 and was ineffective against race 216. The 'E' governed resistance to race 216 and was hypostatic to a dominant inhibitor-gene 'I_E' present in certain varieties susceptible to race 216.

2. Moravia, 64Q and Victoria: All three varieties have the 'V' gene which conditioned moderate resistance to races 203, 258 and 276. In reaction to race 216, all three have the inhibitor-gene 'I_E'.

3. Bond: Resistance of Bond to race 258 was controlled by the 'b^R' allele. Two other alleles, 'B' and 'b', conditioned susceptibility. The dominance relationship within this allelic series is postulated as: 'B' > 'b^R' > 'b'. The 'b^R' was also hypostatic to the dominant inhibitor-gene 'I_b' found in some of the varieties susceptible to race 258.

4. Landhafer: A partially dominant 'L' gene governed resistance to races 203, 216 and 258.

5. Santa Fe: Data from Santa Fe x susceptible crosses suggested that a single 'S' gene controlled resistance to races 203, 216 and 258. Inter-crosses among Santa Fe, Bage and Trispernia suggested that in addition to 'S', Santa Fe also carried 'M' and 'U' for rust resistance. Alleles of 'M' and 'U' were present also in Bage and Trispernia and controlled a lower level of resistance than 'S'. The three genes appeared to be linked.

6. Bage: The 'U' gene in Bage controlled moderate resistance to races 203 and 258, and the 'M' gene conditioned moderate resistance to race 216.

7. Trispernia: Three independent genes ('R', 'T' and 'U') controlled moderate resistance to race 203. The 'M' gene controlled resistance to race 216 and 'U' conditioned resistance to race 258.

Each of the five susceptible varieties is postulated to have the recessive alleles of the 'E', 'L', 'M', 'R', 'S', 'T', 'U' and 'V' genes, respectively. Criolla Saltena and Gopher have the inhibitor-genes, 'I_E' and 'I_b', and the 'B' allele for susceptibility to race 258. De Argelia and Dom Pedrito have both inhibitor-genes and the 'b' allele. La Prevision appeared to have 'I_b' only.

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Transgressive segregation for higher levels of resistance was observed among progenies of resistant x resistant crosses in reaction to races 203 and 258.

Ascencao, Moravia, 64Q and Victoria were susceptible to Helminthosporium victoriae, whereas the other ten varieties were resistant. F_2's from selected crosses between the two groups of parents were tested to H. victoriae and a race of P. coronata avenae for correlated study. The observed results were in agreement with the hypothesis that the 'V' gene for crown rust resistance was either pleiotropic or closely linked with the gene for susceptibility to H. victoriae.

Microfilm $2.00; Xerox $7.20. 151 pages.

SYSTEMATIC, MORPHOLOGICAL, AND LIFE HISTORY STUDIES ON THE TREMATODE FAMILY BRACHYCOELIIDAE JOHNSTON, 1913.

(L. C. Card No. Mic 59-4216)

Thomas Clement Cheng, Ph.D.
University of Virginia, 1959

The systematics of the trematode family Brachycoeliidae Johnston, 1913 is re-evaluated. In light of more recent morphological and life history studies, a modification of the taxonomy of this family is presented. To this family have been assigned the subfamilies Brachycoeliinae Looss, 1899; Leptophallinae Dayal, 1939; Glypthelminae n. subfam.; and Mesocoeliinae Dollfus, 1929.

Revised definitions of the family, subfamilies, and genera are presented and these definitions are supported by discussions of the inter-relationships of the species of which they are composed. Within the annotated list of species in each subfamily are included a summary of the distribution and host records of each species, a diagnosis, or description, of each together with a historical account of its nomenclature. Taxonomic keys to the subfamilies, genera and species are given.

To the Brachycoeliinae has been assigned the genera Brachycoelium Dujardin, 1845 (comprising of B. salamandrae, B. obesum, B. mesorchium, B. georgianium, B. trituri, B. storeriae, B. daviesi, B. meridionalis, B. louisianae and B. elongatum) and Cymatocarpus Braun, 1901 (comprising of C. solearis and C. undulatus). A new species, B. elongatum, is added to the previously known members of the genus Brachycoelium.

The monotypic family Leptophallinae is recognized to include L. nigrovenosus Lühe, 1909.

The subfamily Glypthelminae is proposed to receive the genera Glypthelmins Stafford, 1905 (comprising of G. quieta, G. subtropica and G. festina); Margeana Cort, 1919 (comprising of M. californiensis, M. linguatula, M. repanda, M. shastai, M. simulans, M. proxima and M. sera) and the monotypic Reynoldstrema n. gen. is erected to receive R. africana.

The genus Mesocoelium Odhner, 1911 (comprising of M. sociale, M. mesembrinum, M. megaloon, M. oligoon, M. microon, M. carli, M. incognitum, M. meggitti, M. lanceatum, M. monodi, M. ovatum, M. japonicum, M. americanum, M. burti, M. marrsi, M. danforthi, M. geoemydae, M. leiperi, M. minutum, M. travassosi, M. crossophorum, M. sibynomorphi, M. mesocoelium, M. maroccanum, M. georgesblanci, M. magrebense and M. brachyenteron) is the sole genus of the family Mesocoeliinae. The previously recognized genus Pintnaria is considered to be a synonym of Mesocoelium.

The life history of Brachycoelium obesum Nicoll, 1914 is given. This trematode utilizes only one intermediate host, the common land snail, Zonatoides ligerus, or the land slug, Agrolimax agrestris. Within the intermediate host the parasite undergoes two sporocyst generations, the cercarial generation which transforms into the unencysted metacercaria. When the intermediate host is ingested by the definitive host, Plethedon cinerus, the metacercaria develops into the adult. The eggs of the worm do not develop into miracidia until they are ingested by the intermediate host.

Illustrations of all the species of the family are included. Microfilm $4.00; Xerox $13.60. 311 pages.

STUDIES ON THE TOBACCO MOSAIC VIRUS NUCLEIC ACID.

(L. C. Card No. Mic 59-3380)

Benjamin S. Friesen, Ph.D.
Iowa State College, 1959

Supervisor: Dr. Robert L. Sinsheimer

Since 1956 it has been known that ribonucleic acid (RNA) from tobacco mosaic virus can infect the host plant and initiate the reproduction of virus like that from which it was isolated. This implies that the structural codes for both the RNA and the specific viral protein reside in the RNA. Because physical and chemical characterization of the RNA is necessary for the understanding of its biological functions, information concerning the physical size and structure of the infective unit were obtained by partition cell ultracentrifugation, velocity sedimentation, light scattering, and ultraviolet light absorption experiments on RNA isolated from the virus either by sodium dodecyl sulfate (SDS) or water-saturated phenol.

RNA prepared by either method had a molecular weight of 2×10^6 as determined by light scattering and a sedimentation constant of 34 S in 0.2M salt plus 0.001M phosphate.

The extinction of RNA reversibly increased 30% in 0.2M salt plus 0.001M phosphate as the temperature was increased from 7 to 80°C. At 37°C the extinctions of SDS RNA given for moles of phosphorus per liter were 10,200, 8980, and 8130 in deionized distilled water, 0.02M phosphate pH 7.3, and 0.2M salt plus 0.001M phosphate pH 7.5 respectively. The values for phenol RNA were 10,200, 9130, and 8250. These results were interpreted to mean that intramolecular hydrogen bonds may be reversibly ruptured.

At 25°C the kinetics of the spontaneous degradation of RNA as followed by light scattering showed that the reciprocal molecular weight was proportional to the time. This behavior would be expected of an initially monodisperse single stranded polymer if the probability that a given bond is fractured is proportional to the time.

Partition cell experiments on undegraded RNA and on RNA partially degraded at 25°C demonstrated that the

infective unit had a sedimentation constant of 30 S in 0.02M phosphate pH 7.3 in agreement with that of intact high molecular weight RNA.

The RNA lost its infectivity at 25°C at a rate equal to that at which RNA decayed into smaller units. The latter was determined from the decrease in the area remaining under the leading peak in Schlieren photographs.

It was concluded that units smaller than that of the intact RNA did not carry infectivity and that the infective unit may correspond to the total RNA content of single virus particles. Microfilm $2.00; Xerox $5.20. 104 pages.

CYTOGENETIC STUDIES OF GAMMA RADIATION OF MAIZE.

(L. C. Card No. Mic 59-4237)

Te-Hsiu Ma, Ph.D.
University of Virginia, 1959

The ontogenetic development of Zea mays L. was studied in the green house and the field. Ten ontogenetic phases were determined by morphological features. These covered the period from anther formation, microsporegenesis and sexual cell differentiation. Four cytological phases within this period were used for the study of effectiveness of induction of chromosome aberration and gene mutation. These are pre-meiotic, meiotic, pollen mitotic and mature pollen respectively. These four cytological phases can be delimited by the morphological features of the ontogenetic phases.

Eleven hundred r of gamma irradiation from a cobalt-60 source was applied in a twenty three and half hour period to the dominant tester plants at the early stages of each of the four cytological phases. Chromosome aberrations were determined from the material fixed at the cytological phases following the phase to which the treatment was applied, and from the fixations made immediately after treatment as well as from the fixations of F_1 plants. Mutations concerned in this investigation were confined to the endosperm characters and aleurone color of the corn kernel. Genetic study was done by pollinating irradiated dominant tester stock to the untreated recessive tester stock. Gross mutants were scored from the resulting ears, psuedo-mutants and true mutants were differentiated by raising the gross mutant seeds and analyzing the ears which resulted from the selfed F_1 plants. Pollen mitotic phase was found to be the most effective period for the induction of chromosome aberration and genetic change.

A high rate of fragment-free bridges was scored in the F_1 population in addition to the expected transmitted aberrants. Heterofertilization played an important role in the genetic events. Restitution and rejoining of broken chromosomes and the screening out of fragment through cell division were apparent.

Microfilm $2.00; Xerox $4.40. 85 pages.

THE EFFECT OF ENVIRONMENTAL FACTORS ON CROSSING OVER IN NEUROSPORA CRASSA.

(L. C. Card No. Mic 59-3712)

Barbara Anne Drake Maling, Ph.D.
Stanford University, 1959

Thirty-five agents, some of known metabolic action, were tested for their effect on crossing over in Neurospora crassa.

The agents were first screened for effect on crossing over by measuring the frequency of prototrophic recombinant progeny segregating in a cross of two linked nutritional mutants.

The most effective agents were tested further by analyzing ordered asci (350 to 500 for the control and each treatment) from a cross containing markers delimiting five intervals in two linkage groups.

Nutritional requirements among progeny segregating in this cross were tested by replica plating. A morphological mutant was found to have a growth habit suitable for replica plating, and was made homozygous in the cross used for tetrad analysis.

When ripe perithecia from crosses homozygous for this mutant were submerged in water, complete asci were extruded separately and large numbers of asci could be collected rapidly with a capillary pipette. The colonies arising from individual ascospores were replicated by means of a set of fixed needles.

In order to estimate accurately the exchange frequencies in gene-centromere intervals, it was necessary to correct for ascospore rearrangements which could be attributed to partial overlap of second division spindles. Equations were derived which describe all observed segregation patterns as functions of crossing over and partial overlap. These equations were solved by the method of maximum likelihood. The frequency of partial overlap was significantly increased by the treatments.

Positive chiasma interference occurred in both linkage groups, but was stronger in one group than in the other. Chiasma interference was not affected by treatment. Evidence for negative chromatid interference was highly significant.

Crossing over was found to be influenced by temperature of incubation, by deficiency of magnesium sulfate, and by addition of actidione, p-fluorophenylalanine, and 5-bromouracil.

p-fluorophenylalanine and 5-bromouracil altered the distribution of exchanges but not the overall frequency within chromosome arms. p-fluorophenylalanine caused a significant increase in crossing over near one centromere, and 5-bromouracil caused significant decreases in mid-arm intervals.

It is possible that the analogues, 5-bromouracil and p-fluorophenylalanine, replace thymine and phenylalanine in chromosomes, thereby affecting the distribution of genetic exchanges.

(In the course of this work, linkage data were obtained for 14 loci in linkage group IV.)

These results have been prepared for publication.

Microfilm $2.00; Xerox $4.40. 83 pages.

GENETIC VARIATION OF HELMINTHOSPORIUM SATIVUM IN RELATION TO SEEDLING BLIGHT OF SMALL GRAINS.

(L. C. Card No. Mic 59-3783)

Leon S. Wood, Ph.D.
University of Minnesota, 1958

Adviser: J. J. Christensen

The present investigations have substantiated and greatly expanded the information on the variability and genetic variation within the species Helminthosporium sativum. Of the 103 isolates tested, 52 per cent were pathogenic on barley, 63 per cent on wheat, and 31 per cent on oats. There was a high degree of association of the relative pathogenicity of a given isolate on barley, wheat, and oats. Isolates pathogenic on barley tended to be pathogenic on wheat to a high degree, and also on oats, but to a lesser degree. Twenty-eight per cent of the isolates were pathogenic on barley, wheat, and oats, 19 per cent on both barley and wheat, 15 per cent on wheat only, 5 per cent on barley only, one per cent on wheat and oats, one per cent on oats only, and 31 per cent caused no apparent damage on any of the three hosts. There was no association between the source of the isolate and its virulence. Pathogenic and weakly pathogenic isolates were obtained from isolations made from seed, leaves, or culms of barley, wheat, oats, rye, flax, and quackgrass that were obtained from 17 states.

Genetic changes occur frequently in monosporous cultures of H. sativum. Of the 30 monosporous lines derived from the highly virulent monosporous parent culture 61, 29 lines were pathogenic, but one was virtually innocuous. All of the 30 monosporous lines derived from the moderately virulent parent culture 93 were pathogenic. Of the 19 monosporous lines derived from the weakly virulent parent culture 208, 15 lines were pathogenic and 4 lines were weakly pathogenic. It is rather significant that monosporous lines derived from the moderately and highly virulent parent cultures tended to be of the same or of greater virulence than the parent, while the progeny derived from the weakly virulent parent culture tended to be of the same or of lesser virulence than the parent.

Three of the four isolates tested on three varieties of barley caused the same relative amount of disease in sterilized and nonsterilized soil. Usually root-rotting pathogens are much more destructive in sterilized soil than in nonsterilized soil. In this case there was little or no evidence of antagonistic action of other organisms against H. sativum.

Inoculation of five barley varieties in the field with a mixture of races of H. sativum resulted in statistically significant reductions in stands, plant heights, and yields. In this test yield losses ranged from 30 to 71 per cent and clearly indicate the injurious effect of H. sativum on barley.

It was demonstrated that leaf blight, caused by H. sativum, may materially reduce the yield of barley, for example, in one variety as much as 34 per cent. The data obtained indicate that the amount of H. sativum leaf blight on barley can be markedly reduced by the application of Sulphur and Manzate (Maneb). By this method it may be possible to obtain more accurate information on losses caused by H. sativum.

Microfilm $2.00; Xerox $5.40. 109 pages.

A REVISION OF THE GENUS PTELEA.

(L. C. Card No. Mic 59-3909)

Virginia Long Bailey, Ph.D.
University of Michigan, 1959

The purpose of this study is twofold: (1) to consider variation and distribution patterns for the genus Ptelea (Rutaceae) in relation to present-day physiographic regions, paleogeographic distribution, and the geological history of North America, and to suggest possible phylogenetic lines of development for modern forms as well as migration routes from centers of origin; (2) to provide a taxonomic arrangement for the genus and clarify the nomenclature. Particular interest attached to this study arises from the face that Ptelea is one of a number of North American plant phylads having similar peculiarities in distribution, with representatives in the highlands of Mexico and a strong east-west division in the United States, and with complex variation patterns apparently unrelated to any present-day physiographic regions.

In Part I of the study, certain variable morphological characteristics were analyzed in populations delimited on the basis of physiographic provinces or their subdivisions. Several methods were employed, including certain semi-statistical techniques for evaluation of populations by means of hybrid index values plotted as frequency histograms or as glyphs on pictorialized scatter diagrams. A more useful procedure, however, for analyzing relationships and comparing trends in variation patterns, proved to be that of mapping occurrences of certain selected morphological characteristics, some of which show distinct clinal relationships from one part of the continent to another.

Correlation of data from population studies and distribution maps with changing land patterns during past geological ages suggests certain relationships between distribution of present-day forms of Ptelea and hypothetical early progenitors. It is postulated that a pubescent form from some southern ancestral area sent migration streams northward along two lines: one, along the western cordillera of Mexico, developing a form with the tendency towards narrow leaflets and large glands; and a second line with broader leaflets along the eastern side, possibly when the Coahuila peninsula may have extended southward nearly to the primitive ancestral area.

It is suggested that a branch from the western line early split off and became separated along the Pacific coast, there giving rise to the Californian Ptelea crenulata which retains the ancestral characteristic of pubescent pistil. Another branch provided the stock for a glabrous narrow-leaflet form, which developed as migration proceeded northward into the Colorado basin, possibly spreading around the Sundance Sea margins during Upper Jurassic, eventually reaching eastward to the Appalachians. Likewise, the east-side migration stream produced several offshoots. One, a xerophytic form, extended westward across northern Mexico from the region of southeastern Coahuila, culminating in the distinctive Baja Californian species, Ptelea aptera, during long isolation on this peninsular (or at times insular) land. Other eastward-trending branches provided the stock for development of the more mesophytic eastern varieties of Ptelea trifoliata subsp. trifoliata, which may have become stabilized on the eastern side of the continent during its long separation from the west by the Cretaceous seas.

Subsequent physiographic and climatic changes during the Cenozoic provided many opportunities for contact between floras from different areas. Final separation, then, of already diversified populations of Ptelea in isolated mountain ranges and plateau canyons since the last pluvial period of the Pleistocene, and chance selection and development in these areas from the complex gene pools, may partly account for the great variation in forms of present-day Ptelea trifoliata.

Part II of the study deals with taxonomic relationships of the genus Ptelea. Three species, five subspecies, and eleven varieties are recognized, but delineation of the taxa reflects more the characteristics of populations than of individuals in the populations. It seems impossible to recognize any systematic combinations of characters apart from geographical distribution.

Microfilm $4.10; Xerox $13.80. 319 pages.

A MONOGRAPH OF THE GENUS ISOTACHIS.

(L. C. Card No. Mic 59-3421)

Raymond Edward Hatcher, Ph.D.
University of Cincinnati, 1959

The genus Isotachis was described by Mitten (1855) and was based upon the species, I. lyallii Mitten. In the course of its history, 115 taxa have been relegated to this genus. Primarily on the basis of qualitative differences in the female inflorescence, 27 taxa have been segregated from the genus. A number of subspecific epithets have been applied to various of the species and, while these are included in the exsiccatae, they are not here considered to have taxonomic standing. Fifteen species were not available for study and of the remaining 55 species, 31 have been reduced to synonomy leaving, finally, 24 species.

It was found that these 24 species could be conveniently divided into four groups on the basis of structural discontinuities. Each of the groups has been designated as a section and each section has been given a name followed by a brief Latin diagnosis and an equivalent English description followed by a key to the species included in the section.

Each species appears in the monograph followed by a list of synonyms and a detailed description. Following the description, there appears a note on habitat, a short paragraph depicting the principal distinguishing characters of the species, a list of exsiccatae with their geographic locations and a concluding paragraph considering the relationship of the particular species and its nearest relative with a view toward clearly distinguishing the two. The description of the species is accompanied by one or more plates of drawings illustrating the habit of the species and all structures pertinent to its determination.

The taxonomic portion of the monograph is followed by a chapter devoted to an examination of specific interrelationships within the genus, the distribution of the genus, its possible place of origin and its evolution. This chapter may be summarized by the following points:

1. It seems unlikely that the species of Isotachis are capable of widespread dispersal by means of wind or water.
2. The genus probably had its origin in an area characterized by temperate climatic conditions.
3. That the Section Isotachis had its origin in a South Temperate area and possibly on a formerly temperate and more extensive Antarctic continent is suggested by both the present distribution of this section and the relationships among its species.
4. The genus Isotachis would appear to represent an extremely old and conservative group.
5. It is emphasized that the over-all distribution of Isotachis is similar to the major distribution patterns among the higher vascular plants of the Southern Hemisphere. It is suggested that this genus and other groups of leafy Hepaticae may provide more reliable criteria for the determination of major distribution patterns than the higher plants. Microfilm $2.70; Xerox $9.20. 205 pages.

THE DIVERSITY OF SPECIES IN NET PHYTOPLANKTON OF THE RARITAN ESTUARY.

(L. C. Card No. Mic 59-3592)

Bernard Clarence Patten, Ph.D.
Rutgers University, 1959

Major Professor: Edwin T. Moul

Information theory was used to compute indices to the diversity of phytoplankton communities in Raritan Bay, based on field sampling from July 1957 through September 1958. The results were formulated into a general theory of ecological succession against a background of knowledge of the hydrography and productivity of the estuary, and the biology of its planktonic flora.

The bay circulation and general hydrography were studied. The extreme values obtained for the parameters measured were: salinity 4.78-28.33 ppth.; temperature 0.2-28.8°C.; dissolved oxygen 2.22-14.20 ppm.; turbidity (η_{660}) 0.37-14.31; density (σ_t) 12.33-19.77; PO_4-P 0.71-12.43 μg-at/liter; NO_3-N 2.8-129.3 μg-at/liter; N/P ratios, by atoms, 1.3:1 to 111.4:1.

Productivity was determined by in situ dark and light oxygen bottle experiments, and associated with levels of chlorophyll. Chlorophyll content ranged from 0-162.8

μg/liter. Gross production at 1 foot depth ranged from -0.39-14.09 μg 0_2/μg chlorophyll/liter/hour. In several experiments, gross production was registered in the absence of detectable chlorophyll. Compensation depths ranged from 1.0-8.9 ft.

A list of phytoplankton taxa encountered was provided, with a record of the months during which each was collected. Accounts of the natural history, ecology, and seasonal and spatial distribution in the estuary of twenty-two of the most important species were given.

The measure of diversity employed was the Shannon-Wiener function, H. This is an entropy, designating the extent to which a community diverges from the conditions of minimum diversity (all individuals belonging to one species) and maximum diversity (every individual belonging to a different species). H, along with associated parameters of interest, was computed with an IBM type-650 digital computer for each net phytoplankton sample collected. The other parameters were (1) the diversity per individual; H/N, (2) the position of H between H_{max} and H_{min}, $(H-H_{min})/(H_{max}-H_{min})$; and (3) the redundancy, (1-H/N) or $(1-(H-H_{min})/(H_{max}-H_{min}))$.

The range of diversity encountered during the study period was 87-487,220 bits/liter, a bit representing the amount of negative entropy necessary to choose between two equally probable alternatives. Seasonal changes in diversity were observed to follow fairly regular patterns. Lines of equal diversity (isoentropic lines) were plotted on outline maps of the estuary for each sampling date to illustrate spatial variability.

Margalef conceives succession in phytoplankton to begin with introduction of new species. As populations develop from these colonizers, community diversity increases. Gradually, as certain forms begin to assert dominance and less successful ones begin to disappear, diversity tends to decline due to increasing redundancy.

In applying this reasoning to the Raritan Bay flora, it was found that the redundancy was actually a better index of stage of succession than total diversity. Three successions were distinguished in an annual period, each progressing from low to high redundancy. In two of the three, total diversity declined as the successions progressed. But in the third, overall diversity increased even though redundancy increased concurrently. This may be interpreted to denote the fact that total members of organisms were increasing faster than diversity, an extremely unstable condition, ecologically, in that it leads to the catastrophic destruction of the communities. This kind of succession was termed exploitative because the resultant communities are geared for a high rate of thermodynamical output and inefficient, wanton, exploitation of biotope resources. The first kind of succession, leading to a stable terminal stage (climax?), was called conservative. The communities involved are geared to a low rate of output commensurate with efficient utilization of the total resource.

The significance of both kinds of successions in the regulation of a steady state was discussed. The fact that there are two kinds with different diversity-redundancy relationships suggests an interesting area for further research in other natural communities: the determination of optimum diversity-redundancy relationships.

Microfilm $3.15; Xerox $10.80. 241 pages.

INFLUENCE OF GRAZING HISTORY UPON RESPONSES OF STIPA COMATA TRIN. AND RUPR. TO FREQUENT DEFOLIATION AND OTHER TREATMENTS AT MILES CITY, MONTANA.

(L. C. Card No. Mic 59-3761)

Roald Arnold Peterson, Ph.D.
University of Minnesota, 1959

Responses of Stipa comata on contiguous areas were compared in the field relative to grazing histories which varied in intensity and in length of protection from grazing. Each of the major variants in grazing history (heavy grazing, moderate grazing and long-term protection) had been in effect for 14 years at the time the study was begun. Length of protection from grazing varied in successive years of the study, which extended over a period of 5 years. Observations were made on responses to frequent clipping (made on different plants each year), on growth response in the dark, and on responses after transplanting to a common environment.

The number of shoots regrowing after successive clippings was highest in the plants which had been grazed most heavily, and which had been protected for the shortest time. The closer the clip was made to the ground (0, 2 or 4 cms.) the fewer the number of shoots regrowing between successive clippings except for long-term protected plants where differences were not significant. Total height growth, of both clipped and unclipped plants, was least in the plants which had been grazed most heavily and which had been protected for the shortest period of time, and was inversely related to closeness of clipping. Total herbage yields increased with the length of protection and decreased with increasing intensity of past grazing, as did the percentage of total yield comprised by the initial clip. Yield of clippings made subsequent to the initial clip were similar irrespective of grazing history; and relative to the initial clip, it was highest for the plants with the most intense and most recent grazing. Yield of harvested herbage was similar at the three levels of clipping. Total herbage growth increased with height of clipping. Average weight of the clipped shoots was inversely related to the intensity and recency of grazing. Shoot weight in successive clips varied least in the plants which had been heavily grazed. After the initial clip, the higher the level of clipping the greater the harvested weight per shoot. Regrowing shoots of plants which had received long-term protection were usually light green and often had chlorotic spots and drying tips, whereas the regrowing shoots of plants which had been recently grazed were a uniform dark green color. Survival through the winter following clipping increased with length of protection and with increasing height of clipping.

Herbage growth in darkness and the duration of growth increased with length of time during which the plants had been protected. Amount of growth during the first 8 days relative to total growth was greatest in the plants which had most recently been heavily grazed and least in the plants which had received long-term protection.

After five years in a common environment, transplants from the heavily grazed part of the area still grew to a shorter height, had narrower leaves, had the axil of the first leaf closer to the ground, and had a greater tendency

toward procumbent growth than did the transplants from the long-term protected area. This persistence of differences was attributed to natural selection.

Observed growth responses, modifications and genetic selection are discussed in relation to plant survival under continued heavy grazing. It is postulated that the changes induced in Stipa comata were such as to favor its chances for survival under continued heavy grazing. It is suggested that modifications and natural selection of biotypes more able to survive under heavy grazing may account in part for the high degree of stability of the vegetation of the Great Plains under heavy grazing.

Microfilm $2.00; Xerox $4.40. 82 pages.

A REVISION OF THE GENUS DICENTRA BERNH. (FUMARIACEAE)

(L. C. Card No. Mic 59-3766)

Kingsley Rowland Stern, Ph.D.
University of Minnesota, 1959

Hutchinson, who monographed the genus Dicentra in 1921 as part of a larger treatment, was followed to a considerable extent in 1936 by Fedde in his monograph of the Papaveraceae. Fedde's treatment of the genus was, however, incomplete. Since Hutchinson's monograph appeared, several new taxa have been proposed, and with additional material now available, the status of some of these taxa appears questionable. It has also become increasingly clear that a sharper delineation of species is necessary, especially in the subgenus Dactylicapnos.

The study reported here is based primarily on floral and vegetative morphology, but a limited amount of cytological and anatomical investigation also was undertaken. Many features were studied, and of these the following have proved to be of the greatest importance diagnostically:

1. Subterranean portions of the plant. In addition to the smaller roots, bulblets, tubers, taproots, rhizomes or a combination of two or more of these structures may be present.

2. Form of the leaflets. The margins may be incised-pinnatifid, serrate to crenate, or entire. The ultimate leaflets are modified as tendrils in the subgenus Dactylicapnos.

3. Form of the inner petals. Both the blade and the claw of these petals exhibit interspecific variation in the subgenera Chrysocapnos and Dicentra.

4. Form of the phalange. The median stamen of each phalange may be similar to the two lateral stamens or it may be bulged out or spurred towards the base. There appears to be a phyletic series in which the primitive condition presumably is that in which all three stamens of the phalange are similar. The median stamen then appears to have bulged out, doubled back on itself, and through concrescence of the doubled tissues, formed a spur which projects into the outer petal bases.

5. Form of pollen grains. The pollen grains are basically tricolpate or 6-rugate, but there is interspecific variation in exine ornamentation in the subgenera Chrysocapnos and Dicentra.

6. Form of the testa. The testa exhibits considerable interspecific variation in sculpturing and form in the subgenus Dactylicapnos.

As a result of these studies, the genus Dicentra is here divided into three subgenera, two of which occur in both North America and eastern Asia, while the third is confined to southeast Asia. One subgenus, Chrysocapnos, is divided into three sections, two of which are herein proposed for the first time. In the section Chrysocapnos, one new variety is proposed, and in the subgenus Dactylicapnos a new species is circumscribed. Several realignments of taxa, based on new evidence presented, are proposed. A total of 19 species in all is recognized.

Microfilm $2.60; Xerox $9.00. 198 pages.

THE SHOOT APEX IN THE FAMILY MALVACEAE.

(L. C. Card No. Mic 59-3607)

Robert John Tolbert, Ph.D.
Rutgers University, 1959

Major Professor: Marion A. Johnson

This study consists of two related parts dealing with the shoot apex in the family Malvaceae: I. A seasonal study of the vegetative shoot apex and the pattern of pith development in Hibiscus syriacus L.; and II. A survey of the vegetative shoot apices in the Malvaceae.

Most of the species investigated are recorded as having a more or less marked cytohistological zonation superimposed on the tunica-corpus configuration. In an effort to give a more accurate concept of apical structure and activity, the apex has been described as the promeristem and its derivatives, the flanking meristem and the pith rib meristem or pith mother cells. The promeristem, consisting of the tunica initials and the corpus initials, is the focal point of the study of the zoned apices.

The shoot apex of Hibiscus syriacus is generally flat-topped. It has a promeristem comprised of large, light-staining, vacuolate cells that have thick cell walls and exhibit much dark-staining intercellular substance. Surrounding the promeristem is the flanking meristem, which is responsible for the outer layers of the shoot and from which the leaf primordia arise. The pith rib meristem lies below the promeristem and consists of files of cells that are responsible for the pith.

There are no major seasonal changes in the structure of the apex during the yearly cycle. Seasonal variation in the activities of certain apical derivatives is discussed. The pith displays a long shoot type of development with the cells remaining in distinct files during the first flush of growth in the spring. As growth slows and internode elongation is gradually reduced, the pith displays the characteristic short shoot type of development, consisting of a spongy tissue of rounded cells with many intercellular spaces and no distinct files of cells.

A crown is differentiated across the top of the pith at the end of the growth period. This consists of a band of cells with thick dark-staining cell walls which separates

the apex from the last year's growth. In contrast to many gymnosperms, this crown is dispersed by renewed cell activity the following spring.

The survey of the vegetative shoot apices in 30 species from the family Malvaceae reveals a wide range of size, shape and zonation. The tunica is single-layered in all but three species, but stratification of the upper corpus is common. Data are given in tabular form for the measurement of the promeristem, measurement of the apical dome, type of flanking meristem, origin of the pith, and growth habit of the plant.

There appears to be a correlation between the distinctness with which the promeristem is marked off from the surrounding tissue and growth habit. Most of the herbaceous species have an indistinctly marked promeristem, whereas the shrubby trees and trees have a distinctly marked promeristem. Zonation in shrubs and suffrutescent plants may be of either type.

Microfilm $2.00; Xerox $4.00. 71 pages.

AN ECOLOGICAL AND TAXONOMIC SURVEY OF THE CHLOROPHYTA OF THE JAMES RIVER BASIN, VIRGINIA.

(L. C. Card No. Mic 59-2654)

Bernard Robert Woodson, Jr., Ph.D.
Michigan State University, 1958

Major Professor: G. W. Prescott

This is a study of the distribution, classification, and ecology of the Chlorophyta of the James River Basin. The chief objectives of this study have been: (1) the collection and identification of green algae (Chlorophyta) from representative points along the James River Basin; (2) the determination, where possible, of the geological or soil features and chemical factors related to the distribution of Chlorophyta along the James River Basin; (3) the assembling of ecological data related to algal development in streams in general.

This is the first detailed study made on the Chlorophyta of the James River Basin. Dr. J. C. Strickland of the University of Richmond in Richmond, Virginia has made a study of the blue-greens (Cyanophyta) of this area and several other persons have reported species from the basin. No formal study, however, has been made on the distribution and ecology of the green algae of the area covered by this investigation.

The writer has also made an attempt to discuss certain aspects of algal ecology of streams in general. This was done by using data accumulated by many phycologists and other stream biologists. This discussion does not treat all of the information that has been accumulated on stream ecology, but it is thought that enough data are presented to emphasize the importance of certain factors on algal development.

In order to carry out the major objectives of this study, representative algal and chemical samples were collected from points along the James Basin. Samples were collected from the headwaters to the mouth on both sides of the river. Such sampling was followed throughout all seasons of the year.

Beginning in August, 1955 samples were taken from both sides of the James, making certain that representative collections were taken from each county bordering the river and so that each parent soil type of the basin was included. At least two, often more, samples were taken from streams emptying into the James from each county. A total of 97 points were sampled by the author, and Dr. J. C. Strickland of the University of Richmond contributed 16 collections.

In the summer of 1956, the same collection points were again covered. Samples were taken from the main tributaries for chemical analyses. The chemical analyses of these streams had been made by the Department of Conservation, Division of Water Resources of Virginia, but phosphorus analysis had been omitted from the data; therefore, the author made phosphorus determinations using the "Molybdate Colorimeter Method."

The samples were scrutinized in the laboratory and each species observed was recorded. A drawing was then made of the species by use of the camera lucida. Seven plates of species numbering 82, and two maps supplement the written text.

After summarizing the results of this survey, several observations can be made. (1) The number of Chlorophyta inhabiting the tributaries of the James River Basin is relatively low. (2) The pH of the streams ranges from 6.4 to 7.6. It is quite difficult to determine the direct influence of pH on the number of species; however, it was observed that the streams with the largest number of species were slightly on the acid side of the pH scale. (3) Streams that were slightly soft (low in $CaCO_3$ content) had the greatest number of species. However, the influence of hardness as a single factor on algal distribution is difficult to determine. It is thought that other factors tend to interact with hardness to influence distribution. (4) The nitrogen-content of a stream does influence the distribution of species; however, it has been pointed out that low-content of nitrogen in a stream may be influenced by the volume of growth in the stream. If growth rate is low, the nitrogen-content may be high. (5) Pollution is considered as possibly a factor limiting the number and kinds of species inhabiting a stream. Organic pollution may tend to increase the nitrogen-content of a stream; thus, acting as a fertilizing factor. The streams in this study that seemed polluted were quite limited in numbers of species; however, those forms that were able to survive were quite prolific in their growth. (6) Current-rate seemed to greatly influence the productivity of a stream. The swifter streams in this survey were less productive than the slower. However, there were a few exceptions in that two or more streams that were quite slow were not especially productive, but this was thought to be due to other factors such as pollution, hardness, pH, turbidity, etc. In general the swifter streams were almost devoid of both algae and higher plants, but those that could survive the hazard of swift currents usually thrived quite well.

Microfilm $2.65; Xerox $9.20. 201 pages.

CHEMISTRY, GENERAL

PREPARATIONS AND REACTIONS OF SOME 1,2-DIAROYLCYCLOBUTANE, CYCLOPENTANE AND CYCLOHEXANE DERIVATIVES.

(L. C. Card No. Mic 59-4228)

Grover Cleveland Helsley, Ph.D.
University of Virginia, 1959

The study of conjugated systems of the type found in unsaturated 1,4-diketones, including 1,2-dibenzoycyclopropane in which the cyclopropane ring replaces the ethylene double bond furnishing the link conjugating the two carbonyl groups has been extended in two senses; one, to include the double bond in a small ring, cyclobutyl, and cyclohexyl; and two, to substitute the cyclobutane ring for the double bond or cyclopropane ring as the conjugating link. This work has required synthetic studies and it has led to investigation of reactions of some interesting compounds which were involved or related.

Following earlier studies by Fuson, cis and trans 1,2-dibenzoylcyclobutanes and 1,2-dibenzoylcyclobutene were reinvestigated.

Dibenzoylcyclobutene on reduction with sodium hydrosulfite gave dibenzoylcyclobutane which, unexpectedly, was in the cis form; and it was reduced to 1,2-dibenzoylbutane on treatment with zinc and acetic acid. trans-1,2-Dibenzoyl- and trans-1,2-dimesitoylcyclobutanes also were shown to undergo the facile reductive cleavage by zinc and acetic acid. The mechanisms of these reactions, which presumably involve a 1,6 reduction step, the steric implications, and the probably real though small conjugative effectiveness of the cyclobutane ring, have been considered.

1,2-Dibenzoylcyclobutane, and also 1,2-dibenzoylcyclopentane, failed to undergo furanization when treated with dehydrating reagents which are known readily to convert 1,2-dibenzoylcyclohexane to the corresponding iso(tetrahydrobenzo)furan. These results show that the ring strain is important in the cyclization steps necessary for closure of the furan nucleus in the 2.3.0 and 3.3.0 bicyclic ring systems.

trans-1,2-Di-(diphenylhydroxymethyl)cyclobutane underwent double dehydration to tetraphenyldimethylenecyclobutane, and straightforward displacement reactions, all without rearrangement. These reactions are to be contrasted with the rearrangements occurring in the reactions of the trans cyclopropane analog.

trans-1,2-Di-(diphenylhydroxymethyl)cyclopentane when treated with ethanolic sulfuric acid or with thionyl chloride was shown to undergo intramolecular dehydration without rearrangement to 2,2,5,5-tetraphenyl-3,4-cyclopentanotetrahydrofuran.

1,2-Dibenzoylcyclohexane, the 1-cyclohexene and 1,4-cyclohexadiene and derivatives, have been synthesized utilizing Diels-Alder reactions with butadiene and 2,3-dimethylbutadiene and the dienophiles, dibenzoylethylene and dibenzoylacetylene. It has shown that cis-dibenzoylethylene reacts with difficulty with purified 2,3-dimethylbutadiene to give a new cis adduct, but failed to react with butadiene under similar conditions.

Some interesting reactions of 1,2-dibenzoyl-1,4-cyclohexadiene have been investigated, and new, efficient syntheses of 1,3-diphenylisobenzofuran and 1,3-diphenyl-4,5-dimethylisobenzofuran have been developed.

1,2-Dibenzoylcyclohexene on reduction with sodium hydrosulfite gave exclusively 1,3-diphenyl-4,5,6,7-tetrahydroisobenzofuran, presumably through 1,6-reduction to the dienediol with subsequent monoketonization, cyclization and dehydration to the furan.

1,2-Dibenzoylcyclohexene on treatment with sulfuric acid in methanol did not give a cyclic diketal, but gave instead 1,3-diphenyl-4-methoxy-4,5,6,7-tetrahydroisobenzofuran. It adds phenyllithium or phenylmagnesium bromide and is cyclized in the process to 1-hydroxy-1,3,3-triphenyl-1,3,4,5,6,7-hexahydroisobenzofuran. Mechanisms for these reactions have been proposed.

1,3-Diphenyl-4,5,6,7-tetrahydroisobenzofuran on treatment with phosphorus pentachloride and subsequent methanolysis gave 3-chloro-1,2-dibenzoylbenzene, instead of the expected cyclic diketal.

Some 1,3-diphenyl-tetrahydroisoindoles have been prepared and their ultraviolet absorption spectra are compared with those of similarly substituted pyrroles.

Microfilm $2.00; Xerox $6.60. 136 pages.

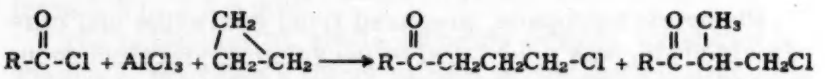
THE ACYLATION AND ALKYLATION OF CYCLOPROPANES WITH AN APPENDIX ON THE ROLE OF STYRENE IN THE RACEMIZATION OF (1-CHLOROETHYL)BENZENE.

(L. C. Card No. Mic 59-2640)

George Levitt, Ph.D.
Michigan State University, 1957

Major Professor: Harold Hart

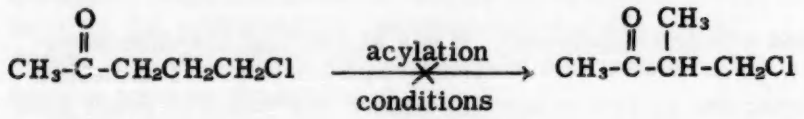
The acylation of cyclopropane was previously[1] found to proceed smoothly at 0° to give a 60-80% yield of a mixture of two isomeric ketones. These were shown to be the anticipated -chloroketones, and the unexpected β-chloroketones, the latter product predominating.



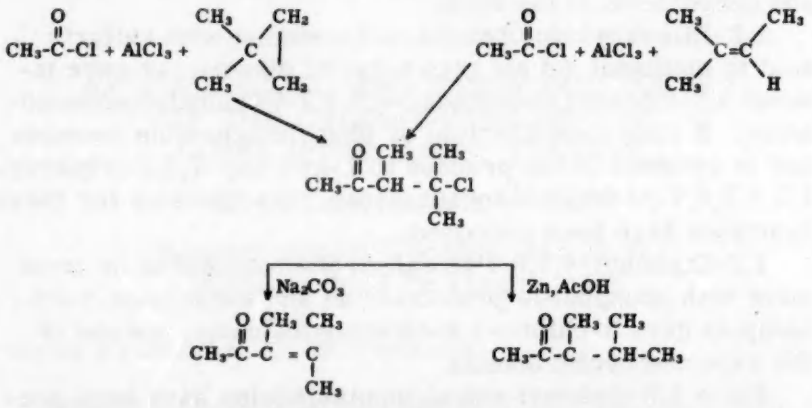
It was the purpose of the present work to examine the scope and generality of this reaction, with the hope also of shedding light on the mechanism by which the unanticipated β-chloroketones were produced.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

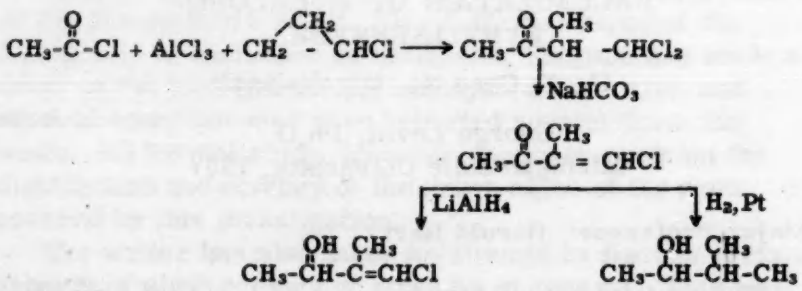
The β-chloroketones from the reaction of acyl chlorides with cyclopropane are not the result of a rearrangement of the γ-chloroketones, but rather appear to be direct reaction products. Thus 5-chloro-2-pentanone did not rearrange under acylation conditions, nor was the yield of 3-methyl-3-buten-2-one affected by the presence of added 5-chloro-2-pentanone in the acylation mixture.



Several substituted cyclopropanes were investigated. 1,1-Dimethylcyclopropane, and acetyl chloride gave 4-chloro-3,4-dimethyl-2-pentanone in 49% yield. The structure was indicated by dehalogenation with zinc and acetic acid to 3,4-dimethyl-2-pentanone and by dehydrohalogenation with sodium carbonate to 3,4-dimethyl-3-penten-2-one. The identical chloroketone was also prepared from 2-methyl-2-butene and acetyl chloride.



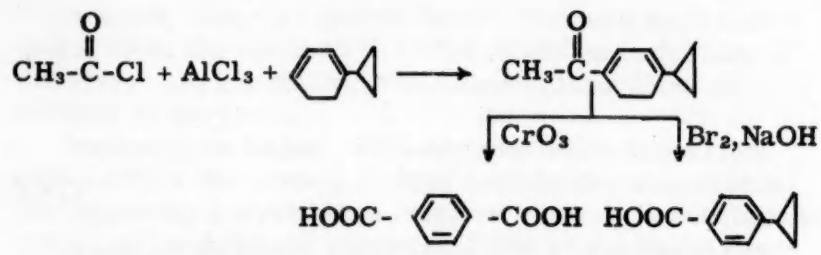
Cyclopropyl chloride reacted with acetyl chloride at room temperature to yield a product too unstable to be distilled. It was probably 4,4-dichloro-3-methyl-2-butanone. Dehydrohalogenation gave 4-chloro-3-methyl-3-buten-2-one, the structure of which was based on elemental analysis, infrared and ultraviolet absorption spectra, and the products from several reactions of the compound. Reduction with hydrogen gave 3-methyl-2-butanol and with lithium aluminum hydride 4-chloro-3-methyl-3-buten-2-ol was obtained.



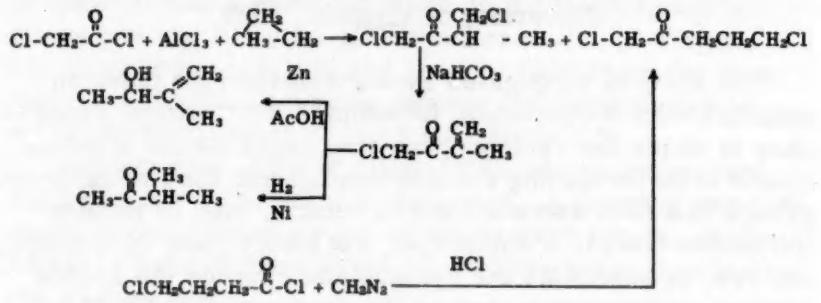
A small amount of another chloroketone was obtained from the acylation, but it was not identified.

1,1-Dichlorocyclopropane reacted slowly with acetyl chloride to yield a small amount of an unstable unsaturated chloroketone which was not identified.

Phenylcyclopropane, prepared from hydrazine and cinnamaldehyde, was acetylated to p-cyclopropylacetophenone in good yield. This product was converted to p-cyclopropylbenzoic acid via the haloform reaction and oxidized to terephthalic acid by chromic oxide. Thus the benzene ring appears to be attacked more readily than the cyclopropane ring.



Several variations in the acylating (or alkylating) agent were also investigated. Chloroacetyl chloride, with cyclopropane, gave both 1-chloro-3-methyl-3-buten-2-one and 1,5-dichloro-2-pentanone, corresponding to the rearranged and normal structures. Proof of structure of the former compound was based on its reduction products. Synthesis of the identical dichloroketone from diazomethane and 4-chlorobutyryl chloride confirmed the structure of the latter.



t-Butyl chloride was found to react with cyclopropane to give a low yield of a mixture of alkyl halides which could not be resolved. The major portion of the product corresponded to $C_7H_{15}Cl$.

Aromatic and aliphatic sulfonyl halides did not yield any significant amount of product with cyclopropane.

No product was isolated from the reaction of acetyl perchlorate with cyclopropane in nitromethane, but 1,1-dimethylcyclopropane gave a small yield of 3,4-dimethyl-3-penten-2-one isolated as its 2,4-dinitrophenylhydrazone.

It appears, then, that the acylation reaction is quite general, and the preponderance of products with an unexpected carbon skeleton (substituted isopropyl, rather than n-propyl ketones) has been confirmed.

In an appendix to the thesis, it is shown that (1-chloroethyl-2,2,2-d_3)benzene does not lose deuterium when allowed to stand with phenol in benzene solution for the equivalent time of one racemization half-life of the optically active chloride. The equilibrium with styrene and hydrogen chloride is therefore unimportant in the racemization mechanism.

Microfilm $2.00; Xerox $5.40. 110 pages.

1. H. Hart and O. E. Curtis, Jr., J. Am. Chem. Soc. 78, 112 (1956).

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

SYNTHESIS OF NEOPENTYL DERIVATIVES OF TRIPHENYL CARBINOL AND THE KINETICS OF BAMBERGER'S REACTION.

(L. C. Card No. Mic 59-3472)

Paul Edward Rowe, Ph.D.
Boston University Graduate School, 1959

Major Professor: Dr. Norman N. Lichtin

Part I

Synthesis of Meta- and Para- Neopentyl Derivatives of Triphenyl Carbinol

The following new compounds were prepared by adaptions of standard methods: p-neopentylphenyldiphenyl carbinol, di-p-neopentylphenylphenyl carbinol, tri-p-neopentylphenyl carbinol, m-neopentylphenyldiphenyl carbinol, and di-m-neopentylphenylphenylmethyl chloride. The preparation of tri-m-neopentylphenyl carbinol was attempted unsuccessfully. Other compounds prepared for the first time as intermediates in these preparations are o- and p-nitroneopentylbenzene, o- and p-aminoneopentylbenzene, o-acetaminoneopentylbenzene, m-bromoneopentylbenzene, 3,5-di-bromoneopentylbenzene, 3-bromo-4-acetaminoneopentylbenzene, 3-bromo-4-aminoneopentylbenzene, p-bromoneopentylbenzene, p,ṕ-dineopentylbiphenyl, and ethyl-p-neopentylphenyldiphenylmethyl ether.

Part II

Kinetics of Bamberger's Reaction

A method was developed for studying reaction kinetics for a two phase system in which reaction occurs in one phase and a reactant is stored in the other phase and transferred into the reaction phase at a rate similar to the rate of reaction. The method is based on the assumption that the rate of transfer of a reactant into the reaction phase depends on the instantaneous concentrations of that reactant in the two phases, the equilibrium concentrations of the reactant in the phases and the effective area between the phases. The method is applied specifically to storage of a reactant in the gas phase and reaction in the liquid phase.

The rate of absorption of nitric oxide by bromobenzene solutions of aromatic nitroso compounds was measured under various conditions. From absorption curves it was determined that:

1. Consumption of reactants in the Bamberger reaction is in quantitative agreement with the equation:

$$ArNO + 2NO \longrightarrow ArN_2^+ + NO_3^-$$

2. Solutions of nitrosobenzene absorb nitric oxide slightly faster than solutions of p-bromonitrosobenzene which in turn absorb nitric oxide faster than solutions of p-nitrosodimethylaniline.
3. The monomer of nitrosomesitylene and not the dimer is the main reactant in the Bamberger reaction.
4. Solutions of the monomer of nitrosomesitylene absorb nitric oxide faster than solutions of p-nitrosodimethylaniline.
5. The kinetic equation of Bamberger's reaction is

$$\frac{d(NO)\text{reacted}}{dt} = k(ArNO)(NO)^2$$

The calculated rate constant for the reaction between p-nitrosodimethylaniline and nitric oxide is 5.49×10^3 liters^2 per mole^2 second at 25°C. The calculated ΔH^+ for the reaction is 3 kcal. per mole.

A tentative mechanism for the Bamberger reaction has been proposed.

Part III

Kinetics of Dissociation of Nitrosomesitylene

The rate of absorption of nitric oxide by benzene and bromobenzene solutions of nitrosomesitylene was measured under various conditions. The shape of each absorption curve was determined by two reactions, a fast reaction between monomeric nitrosomesitylene and nitric oxide and a much slower dissociation of dimeric nitrosomesitylene.

First order rate constants for the dissociation were determined from the latter portion of the absorption curves. The rate constant for the dissociation in bromobenzene solution is 4.35×10^{-4} sec.$^{-1}$ at 6.1°C. In benzene solution the rate constant is 6.1×10^{-4} sec.$^{-1}$ at 6.9°C. ΔH^+ is 25 kcal. per mole in bromobenzene solution and about 23 kcal. per mole in benzene solution. Entropies of activation of 16 e.u. in bromobenzene and about 10 e.u. in benzene were also determined. A heat of activation of about 9.5 kcal. per mole and an entropy of activation of about -30.6 e.u. were calculated for the association of two moles of monomer in benzene solution. This calculation employed quantities of activation for the dissociation of the dimer determined in this work together with the equilibrium data of Ingold and Piggott.

Microfilm $3.80; Xerox $13.00. 296 pages.

CHEMISTRY, ANALYTICAL

THE SPECTROPHOTOMETRIC DETERMINATION OF PALLADIUM(II) WITH TIN(II).

(L. C. Card No. Mic 59-2504)

John Henry Alsop III, Ph.D.
The University of Texas, 1957

Supervisor: Gilbert H. Ayres

Of the three color reactions of palladium(II) and tin(II) studied, one could not be used as a quantitative method. The palladium(II), tin(II), and mercury(II) chloride system, which produced a yellow-orange color with an absorbance maximum at 465 mμ, could not be made stable or reproducible. If this reaction could in some way be stabilized, the optimum concentration range for palladium would be from 1.5 to 3.5 p.p.m.

The palladium(II), tin(II) chloride system, as shown in Figure 2, provides a thirty minute period during which the green colored complex (measured at 635 mμ) gave constant and reproducible absorbances for specific amounts of palladium. The optimum concentration range for the palladium(II), tin(II) chloride system was from 10 to 30 p.p.m. palladium.

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The palladium(II), tin(II) phosphate system was found to be approximately ten times as sensitive as the palladium(II), tin(II) chloride system. The red colored complex formed in the presence of phosphate ion exhibited a very sharp absorption band with a maximum at 487 mμ. The optimum concentration of palladium for this phosphate complex was from 1 to 3 p.p.m.

A combination of the green chloride complex and the red phosphate complex methods offers the analyst a choice of concentration ranges differing by a factor of ten. While the phosphate complex was not stable in the presence of chloride ion, the converse was not true. A standard method of sample preparation could be used with either color developing procedure.

Microfilm $2.00; Xerox $3.80. 66 pages.

THE PRECIPITATION OF HYDRATED COBALT-1-NITROSO-2-NAPHTHOLATE FROM HOMOGENEOUS SOLUTION.

(L. C. Card No. Mic 59-3452)

Phyllis Ambler Brauner, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Arno H. A. Heyn

A method has been developed to determine cobalt by oxidizing cobaltous ion to cobaltic ion and precipitating cobaltic 1-nitroso-2-naphtholate from homogeneous solution by synthesizing the reagent within the reaction mixture. Excess reagent precipitates after the cobalt nitroso-naphtholate has settled. A washing procedure has been developed to eliminate the excess reagent without affecting the cobalt nitroso-naphtholate. After washing to remove excess reagent and filtration, the precipitate is dried and weighed as $Co(C_{10}H_6NO_2)_3 \cdot 2H_2O$.

The presence of fluoride prevents the interference of iron, tungsten and other elements which form strong fluoride complexes.

Radiometric studies were made to determine whether cobalt is quantitatively removed from solution and to establish the fact that iron does not interfere in this method.

Interference studies were made on other ions commonly associated with cobalt; these included the ions of Ni, V, As, Cu, Ag, Mo, W and Cr. Tests for the presence of these elements in the precipitate were made both chemically and spectrographically. Ions of Fe, V, As, Mo, W and Cr were found not to interfere. Ag and Cu ions must be removed and Ni(II) may be present in amounts up to 10 mg.

The precision and accuracy is within 0.1 mg. of Co at a 10 mg. level and within 0.2 mg. of Co at a 50 mg. level.

Microfilm $2.00; Xerox $5.00. 99 pages.

THE POLAROGRAPHIC DETERMINATION OF THE FORMATION CONSTANTS OF MIXED COORDINATION COMPLEXES.

(L. C. Card No. Mic 59-4020)

Donald Lee McMasters, Ph.D.
Indiana University, 1959

The formation constants of complex species in the presence of mixtures of ligands of different basicities have been studied. The method of DeFord and Hume for the determination of the formation constants of simple complexes from polarographic data has been extended to permit the evaluation of the formation constants of the mixed complexes formed in these solutions.

The mathematical analysis involves the following equations:

$$F_{oo} = \sum_{ji} K_{ji}[X]^j[Y]^i \qquad (1)$$

$$F_{oo} = \text{antilog}\left\langle \frac{n}{0.05916}\left[(E_{1/2})_s - (E_{1/2})_c\right] + \log\frac{(i_d)_s}{(i_d)_c}\right\rangle \qquad (2)$$

Equation (1) is a power equation the degree of which is dependent upon the number of complexes that can form. Therefore, by the proper mathematical analysis of this equation, using F_{oo} values as determined from experimental data according to equation (2), it is possible to determine the formation constants and formulas of these mixed complexes.

A combination graphical and least-squares procedure was developed, making use of an IBM 650 electronic computer, for this mathematical analysis. The polarograms of the solutions were also analyzed by applying least-squares calculations to the theoretical equation of voltage of the dropping mercury electrode, E_{dme}, versus log $(i_d-i)/i$ to obtain the half-wave potential ($E_{1/2}$). This technique not only reduced the average time needed to process a polarogram but gave more reliable results.

The mixed complex system of copper(II) with ethylenediamine and oxalate was studied because of its simplicity and because independent data were available on this system for checking the results. Since copper(II) exhibits a coordination number of four, only one mixed complex will form with these bidentate ligands. The formation constants of the simple complexes are used in the calculation of the formation constant of the mixed complex, thus both simple systems were investigated polarographically first. The experimental values found compared quite well with literature values, even though the latter were not determined under exactly the same experimental conditions as in this study. The formation constants obtained in the present study are determined at 25°C. and at an ionic strength adjusted to 1.0 with sodium nitrate.

A value of log $K_{11} = 15.48$ was obtained for the mixed complex, Cu(en)(ox). This value compares well with the literature value of 15.44 obtained spectrophotometrically.

Mathematically and experimentally, the next most complicated mixed complex system would involve the formation of three mixed complexes. The cadmium-ethylenediamine-oxalate mixed complex system was studied as an example of such a system.

The formation constants of the simple cadmium-ethylenediamine complex system were determined and all three

agree quite well with other literature values, the values being: log K_{10} = 5.60, log K_{20} = 10.6 and log K_{30} = 12.1. The values of the three consecutive formation constants for the simple cadmium-oxalate complexes are: log K_{01} = 2.58, log K_{02} = 3.74 and log K_{03} = 5.41.

Using the data from the simple cadmium complex systems together with additional data on the polarographic behavior of cadmium in solutions containing both ligands, the formation constants of the three possible mixed complexes were evaluated for the first time. The complexes and their overall formation constants are: Cd(en)(ox), log K_{11} = 8.02; $Cd(en)(ox)_2^{=}$, log K_{12} = 8.66; and $Cd(en)_2(ox)$, log K_{21} = 11.45.

The constants for both the copper and cadmium mixed complexes are discussed from the standpoints of thermodynamic, structural and coulombic effects.

Microfilm $2.00; Xerox $5.40. 109 pages.

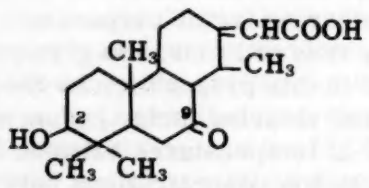
STRUCTURE STUDIES OF CASSAIC ACID.

(L. C. Card No. Mic 59-3653)

Gwendolyn Margaret Sherman, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Walter J. Gensler

Cassaic acid (I) is one of the hydrolysis products from cassaine, an alkaloid found in the bark of Erythrophleum guineense. Earlier investigators formulated cassaic acid as I, with the hydroxyl and ketone groups placed provisionally at positions 2 and 9, respectively. The present work provides experimental evidence proving the correctness of these two assignments.

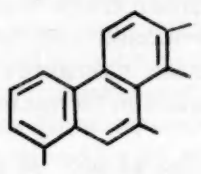


CASSAIC ACID

I

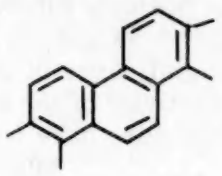
The adduct furnished by reaction of the acetyl derivative of decarboxylated cassaic acid and methyllithium provided 1,7,8,9-tetramethylphenanthrene (II) after selenium aromatization. Since it has been shown in earlier work that cassaic acid compounds are convertible to 1,7,8-trimethylphenanthrene, the extra methyl group at C_9 of the tetramethylphenanthrene must have originated in the insertion of methyl at the carbonyl position. Accordingly, the original carbonyl group is at position 9.

Oxidation and decarboxylation of cassaic acid yielded decarboxylated diketocassenic acid. Methyl Grignard reagent added to only one of the two carbonyls, leaving the original ketone at C_9 unchanged. Reduction of this Grignard adduct followed by selenium dehydrogenation furnished 1,2,7,8-tetramethylphenanthrene (III). The methyl group at C_2 marks the position of the original hydroxyl group, since this methyl group must have originated from Grignard addition to the carbonyl produced by oxidation of cassaic acid.



1,7,8,9-TETRAMETHYL-PHENANTHRENE

II



1,2,7,8-TETRAMETHYL-PHENANTHRENE

III

Microfilm $2.50; Xerox $8.60. 189 pages.

CHEMISTRY, BIOLOGICAL

THE OCCURRENCE AND SIGNIFICANCE OF IRON IN THE TOBACCO MOSAIC VIRUS AND IN ITS INFECTIOUS NUCLEIC ACID.

(L. C. Card No. Mic 59-3678)

Saad Abdulbaki Al-Rawi, Ph.D.
Stanford University, 1959

A modified procedure of dry ashing and chemical analysis for iron was developed. The procedure was applied to the determination of iron in two types of purified tobacco mosaic virus, ultracentrifugally purified virus and that obtained after treatment with strong ammonium sulfate followed by ultracentrifugation. The iron content of the two types of the purified tobacco mosaic virus preparations has been established as 1.5 mg per 100 gm with a 95 per cent confidence interval of 0.2. The iron content corresponds to about 11 atoms per one virus rod. The infectivities of the two types of virus preparations were determined and found to be very comparable.

The iron analyses of several infectious nucleate samples prepared by phenol extraction were determined and compared with the iron content of two samples of infectious nucleate prepared by sodium dodecyl sulfate treatment by Mr. Y. Fujimoto. In contrast to the virus nucleic acid which may contain about 60 mg of iron per 100 gm when prepared by alkali treatment, the samples of infectious sodium dodecyl sulfate-nucleate contained from 1 to 2 mg, and the phenol-nucleate contained from 6 to 10 mg per 100 gm.

The absorption spectra of phenol-nucleate in both water and 0.01 M phosphate at pH 7 were determined. About 7 per cent hypochromic shift was observed in the phosphate buffer when compared with water.

The specific infectivity of phenol-nucleate was determined immediately and after standing for 24 hours at 4° C. The specific infectivity of the nucleate after 24 hours standing was significantly higher than that determined immediately. Repeated phenol extraction did not affect the infectivity of the nucleate produced.

Nucleate fractions differing in absorption characteristics and infectivity were separated by high speed centrifugation. Higher infectivity was associated with the more sedimentable component which also gave a lower value for the ratio of the absorption maximum at 258 mμ to the absorption minimum at 230 mμ.

The possible functions of iron and other trace metals in both the virus and the nucleate were proposed and the possible significance of iron to the adsorption characteristics and infectivity of the nucleate and in relation to nucleic acid structure have been discussed.

Microfilm $2.00; Xerox $4.80. 94 pages.

THE AMINO ACIDS PRESENT IN THE PROTEIN MATERIAL ISOLATED FROM TWO AREAS OF THE SURFACE OF THE TONGUE.

(L. C. Card No. Mic 59-3904)

Charlie James Barnes, Ph.D.
Howard University, 1959

Chairman: Dr. Lloyd N. Ferguson

The fact that the taste sensitive areas of the tongue differ in their ability to respond to sweet, sour, salty, or bitter substances suggests that there might be some differences in the biological materials present in the various sections of the tongue. It is our opinion that the proteins and enzymes present in the various sections of the tongue should be carefully examined.

In connection with our desire to compare the biological materials present in the various sections of the tongue, our first step here has been to examine the protein material isolated from the tip and the center of the upper surface of the tongue for amino acids. A study of the enzymes and proteins of the surface of the tongue in vivo and vitro should logically follow.

The protein was isolated by homogenization of the tissue in 5% trichloroacetic acid. Hydrolysis[1] was carried out in 6N HCl at 110 ± -2°C. over a period of 24 hours. After suitable treatment, the amino acids were separated by chromatography[2] on columns of sulfonated polystyrene resin. The fractions were analyzed by the ninhydrin method of Moore[3] and Stein. The method was standardized by chromatographing a synthetic mixture of amino acids. The assignment of names to the ninhydrin-reacting substances from the hydrolysates was checked by applying the chromatographic procedure to a 50-50 combination of the synthetic mixture and the hydrolysate.

Tryptophane was detected by spectrophotometric[4] analysis of a solution of the protein in 0.1N NaOH.

No significant differences were found in the bound amino acids present in the two areas of the tongue.

Microfilm $2.00; Xerox $3.00. 55 pages.

1. Hirs, C. H. W.; Stein, W. H.; Moore, S., J. Biol. Chem., 211, 941 (1954).

2. Moore, S.; Stein, W. H.; Spackman, D. N., Anal. Chem., 30, 1185 (1958).

3. Moore, S.; Stein, W., J. Biol. Chem., 211, 907 (1954).

4. Goodwin, T. W.; Morton, R. A., The Biochem. J., 40, 629 (1946).

NATURE OF POSTHEPARIN PLASMA CLEARING FACTOR.

(L. C. Card No. Mic 59-3446)

Bronius Baskys, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor William C. Boyd

In order to study the lipolytic nature and kinetics of heparin-induced clearing factor, separation and purification of this factor from postheparin human plasma have been carried out by the method developed in this study.

Postheparin human plasma is mixed in equal parts with an ethanol-ether solution at -5° C. On centrifugation of this mixture, an interphase of semi-solid consistency is obtained between the aqueous and ether-ethanol phases. Suspension of this semi-solid layer in veronal buffer of pH 8.1 followed by repeated extractions with ethyl ether results in further purification of the clearing factor preparation. The final purified preparation of clearing factor represents a 130-fold purification (based on protein content) and contains approximately 50 per cent of the total original activity. Attempts to demonstrate the presence of clearing activity in the plasma or serum of normal fasting individuals by this extraction method has not been successful.

The lipolytic activity of clearing factor is measured throughout this study by determining the increase in concentration of nonesterified fatty acids or glycerol and the decrease in the optical density of the system.

Ultracentrifugal and electrophoretic analysis of purified clearing factor preparation show one major and two minor components. Attempts to determine which of the three components obtained by ultracentrifugal separation might be responsible for the lipolytic action of clearing factor have not been successful.

Purified clearing factor preparation consists mainly of protein and is free of lipids. No glycoprotein has been demonstrated in this preparation by the staining method.

The purified clearing factor preparation exerts its optimal activity at temperatures between 37° C. and 40° C. and at hydrogen ion concentrations between pH 7.9 and 8.1. The activation temperature of clearing factor is approximately 10,000 cal.

The Michaelis constant (Km) of clearing factor is calculated to be 0.21 M.

Clearing factor hydrolyzes the triglycerides present in a coconut oil emulsion and in human chylomicra at about the same rate, while it does not hydrolyze triacetin. In the case of coconut oil emulsion, no hydrolysis takes place until a small amount of protein is added to the system. Since the protein can be replaced by the addition of calcium ions, it appears that the function of the protein is to accept the free fatty acids formed during the clearing reaction.

During the first 10 minutes of the reaction, the rate of increase in the concentration of nonesterified fatty acids as well as the decrease in optical density, follow the curve of zero order reaction. No increase in concentration of glycerol is found until the reaction has continued for about 30 minutes.

Pancreatic lipase and clearing factor act alike in respect to substrate specificity and requirement of protein. Since no other comparisons have been carried out, no

conclusion can be drawn as to the actual identity of these two lipolytic agents.

The analytical and kinetic studies on purified clearing-factor preparation show that heparin-induced clearing factor is a lipolytic enzyme which catalyzes the hydrolysis of triglycerides. Further investigations are required to determine the exact relationship between clearing factor and the lipases present in other biological fluids and tissues.

Microfilm $2.00; Xerox $5.80. 116 pages.

COMPARISON AND DEVELOPMENT OF LABORATORY METHODS FOR FORAGE EVALUATION.

(L. C. Card No. Mic 59-3565)

Billy Ray Baumgardt, Ph.D.
Rutgers University, 1959

Major Professor: M. Wight Taylor

The purpose of this study was to develop a simple and yet accurate laboratory method for measuring the nutritive value of forages. The efficacy of several in vitro techniques for potential use in estimating nutritive value was studied using forages of known value as determined in conventional digestibility trials. Included in the methods investigated were two that have been proposed specifically for forage evaluation. The first of these, Digestible Laboratory Nutrients (DLN), involves a mild acid hydrolysis of the forage sample; the weight loss upon hydrolysis, expressed as per cent, equals DLN. In the second method, the per cent of the forage carbohydrate fermented by rumen microorganisms in an artificial rumen is determined. This in vitro digestibility value is used in connection with a regression equation to predict TDN. Also used as laboratory measures of nutritive value were cellulose and dry matter digestion as determined in the artificial rumen. All in vitro values were compared with data from digestion trials with cattle and sheep, including values for (1) TDN, (2) digestible calories per gram, as well as digestion coefficients for (3) organic matter, (4) dry matter, (5) fiber, (6) cellulose, and (7) energy.

The correlation between TDN estimated from carbohydrate fermented in vitro and actual TDN was significant ($P = 0.01$). However, this laboratory method was rather tedious and gave variable results.

No significant relationship was found between DLN (in vitro) and TDN (in vivo).

Of the laboratory methods used, cellulose digestion by rumen microorganisms was the most closely related to the actual digestibility data being significantly correlated to values 1, 2, 3, 4, and 7 above. Although the correlation between in vivo and in vitro cellulose digestion was not significant when both grass and alfalfa hays were considered, the correlation was highly significant ($r = +0.901$) using only the grass hays.

Since cellulose digestion in vitro offered much promise as a measure of nutritive value, studies were made to improve and standardize the artificial rumen procedure for determining cellulose digestion. The factors studied were the type of artificial rumen apparatus, the forage-substrate level, the composition of the buffer-mineral solution, the effect of urea additions, the length of the fermentation period, and day to day variation. The procedure finally adopted may be summarized as follows. A one gram sample of forage-substrate is fermented in a 125 ml. Erlenmeyer flask equipped with a Bunsen valve. The inoculum is supplied by 25 ml. of filtered rumen fluid and 30 ml. of McDougall's artificial sheep saliva (full strength) are used as the buffer-mineral solution. The per cent cellulose digested in 24 hours at 39°C. is determined. Using this method the digestible energy content of forages in calories per gram (Y), can be predicted from per cent cellulose digestion in vitro (X) by the equation $Y = 1295.2 + 33.16X$.

Microfilm $2.00; Xerox $4.40. 85 pages.

THE APPLICATION OF RADIOCHEMICAL METHODS TO THE STUDY OF THE DECOMPOSITION OF C-14 STEARIC ACID DURING SLUDGE DIGESTION.

(L. C. Card No. Mic 59-3566)

Frederick Robert Brofazi, Ph.D.
Rutgers University, 1959

Major Professor: Raymond M. Manganelli

The purpose of this investigation is the application of radiochemical methods to the study of the anaerobic decomposition of C-14 stearic acid during sludge digestion. Preliminary investigation had to be conducted on:

a. factors influencing laboratory batch digestions.

b. selection, modification, and calibration of radiochemical methods to determine the C-14 content of the lipids, volatile acids, CO_2, and CH_4 present during the digestion process.

The factors studied which influence laboratory batch digestions were the quality of the seed material, sludge loading, temperature, and mixing. Incremental feeding of fresh solids every 2/3 or 3 days at 30° C. produced a sludge, which is good seed material, from a sludge which was poor seed material. This preconditioning process by incremental feeding increases the pH and alkalinity and decreases the acidity of the sludge. Thorough mixing was obtained in a 4 liter resin kettle with a 2 blade stirrer rotating 300 rpm 5 minutes every half-hour.

A dry combustion method was selected and applied to conversion of the acid free grease and free fatty acid fractions in sewage sludge to CO_2 and H_2O vapor. A method of separating the digester gas into CO_2 and CH_4 was developed. The CO_2 was trapped as $BaCO_3$. The $BaCO_3$ was acidified and then liberated CO_2 counted in Bernstein-Ballentine tubes as CO_2. A Toepler pump line was calibrated in order to accurately transfer CH_4 from a storage bulb to a gas counting tube for subsequent radioassay. A paper scanning device was developed for the determination of the specific activity of the C_2 - C_7 volatile acids in sewage sludge.

These radiochemical methods were applied to two laboratory batch digestions containing C-14 stearic acid. The dry combustion unit, carbon analysis line, Toepler pump line, and Bernstein-Ballentine gas counting tubes

worked successfully during both laboratory digestions. The paper scanning method was not sensitive enough to detect the low levels of radioactivity present in the C_2 - C_7 volatile acids on the paper strips.

The results of the two laboratory batch digestions are discussed briefly in connection with the four commonly proposed mechanisms for the decomposition of fatty acids.

Microfilm $3.15; Xerox $10.80. 242 pages.

STUDIES OF NEW PURINES AND PYRIMIDINES.

(L. C. Card No. Mic 59-860)

Alfredo Giner-Sorolla, Ph.D.
Cornell University Medical College, 1958

As potential inhibitors of abnormal cell growth, two series of new purines and pyrimidines were synthesized and tested in several biological systems.

In the first series the following chemical transformations were carried out. 6-N-hydroxylaminopurine was synthesized from 6-chloropurine and hydroxylamine. The oxidation of 6-hydrazinopurine with ferric chloride led to a new synthesis of 6-chloropurine. Purine-6-carboxylic acid was transformed to the acid chloride from which amides and the acid hydrazide were obtained. The latter, purine-6-carbohydrazide, was transformed into the acid azide upon reaction with nitrous acid. The acid azide was converted to the methyl and ethyl urethanes which, in turn, were aminated to 6-ureidopurine. 6-Cyanopurine was converted into N-amino-6-purinylamine and 6-hydroxyamidinopurine. The former could also be obtained from purine-6-thiocarboxamide. The catalytic hydrogenation of 6-cyanopurine led to 6-aminomethylpurine.

In the second series, that of trifluoromethylated heterocycles, syntheses of the following purines are described: 6-, and 8-trifluoromethyl, 2-amino-6-trifluoromethyl, 2,6-diamino-8-trifluoromethyl, and 2-amino-6,8-bis-trifluoromethyl. The syntheses of the 2- and 8-trifluoromethyl derivatives both of hypoxanthine and adenine are also described. A number of 6-trifluoromethyl pyrimidines were prepared, some of which served as intermediates for the above purines. They include the uracil, 2-thiouracil, isocytosine and their 5-phenylazo derivatives.

The dissociation and ultraviolet absorption behaviors of some of these compounds were studied. The basic dissociation of the hydroxylamino and the urethane derivatives is lower than that of adenine and these compounds showed an additional acidic dissociation. The substituents of these three purines appear to exert an electron-withdrawing effect. Evidence is again offered for the conclusion that it is the pyrimidine moiety of the purines which accepts the proton in acidic solutions. The cyano group in 6-cyanopurine exerts an acid-strengthening and base-weakening effect which is about as strong as the trifluoromethyl group in 6-trifluoromethyl purine. The trifluoromethyl group exerts a powerful inductive influence which is manifested by base-weakening and acid-strengthening effects on the parent pyrimidines and purines. The electron-withdrawing effect of the trifluoromethyl group was found to be quantitatively greater than the electron-donating effect of the amino group in certain of the purines.

These compounds were tested against Sarcoma 180 and Adenocarcinoma 755 in vivo and in tissue culture. The results of these tests are given and were almost uniformly negative. Some were of doubtful biological activity.

Toxicity data in experimental animals of some of the purines and the possible mechanism of the toxic action are given. The toxicity of 6-N-hydroxylaminopurine was attributed to renal damage caused by deposition of crystals of 2,8-dihydroxyadenine.

Conclusions are drawn regarding the possible reasons for failure of the compounds to elicit any inhibitory effect on experimental tumors. Some of the reasons offered include the intrinsic nature and size of the substituent, as well as the possibility for metabolic alteration. Features of an ideal chemotherapeutic agent are discussed.

Microfilm $2.00; Xerox $6.40. 134 pages.

THE COMPARATIVE BIOCHEMISTRY OF THE SERUM PROTEINS.

(L. C. Card No. Mic 59-3584)

Stephen Keller, Ph.D.
Rutgers University, 1959

Major Professor: Dr. James B. Allison

This investigation was undertaken to investigate the chemical relationships existing among the proteins of four representative vertebrate species. The proteins of human, turtle and chicken blood sera were fractionated by ion-exchange chromatography, employing DEAE-SF cellulose, and the proteins of bovine serum were separated by fractional ammonium sulfate precipitation. Amino acid analyses of several of the proteins so isolated revealed large differences in the amounts of individual amino acids from one protein to another. Even though such differences at times reached 300%, many amino acids were found to exist in constant molar ratios to one another. In the human serum proteins, for example, the arginine and lysine were found to be present in the ratio 1 : 2.3 throughout all of the nine protein fractions analyzed for amino acids. Several other groups of two or three amino acids, present in constant molar ratio, were also found in the various sera, and were found to vary independently of each other, in terms of the absolute amounts of amino acids. From such a finding it was concluded that the proteins of a given blood serum are formed from templates having similarities of such a nature, that peptides of constant amino acid composition (anlagen) are incorporated into the proteins. Proteins having different properties are believed to be formed by the combination of the various peptides in different relative amounts. It was found that the albumins could be characterized in the various sera studied, as being proteins which contain the largest relative amounts of cystine, alanine, arginine and lysine, while the gamma globulins were found to contain the largest amounts of serine, glycine, threonine and valine.

The amounts of each of the amino acids present in the proteins of the various species were compared, and it was noted that each amino acid was present in a characteristic range of values for all of the proteins investigated. The methionine was found to be uniformly low, while the glutamic acid was present in the greatest amount. The only

significant differences in the amino acids from one animal species to another were for the aspartic acid, which was found to be present in greater amounts in the proteins of turtle serum than in any of the others, and for the arginine and lysine, which were higher and lower, respectively, in the chicken's serum proteins than the other serum proteins.

The albumins of human and bovine sera were compared and found to be very similar in their amino acid compositions. Species differences were found, nevertheless, with respect to the amounts of cystine, aspartic acid and alanine.

The problem of protein heterogeniety was also investigated, and it was found that the albumins of bovine serum all appear to be identical, while the albumins of human serum differ in their amounts of cystine. The gamma globulins were also found to be heterogeneous, and it was observed that three gamma globulin fractions are present which differ markedly in their amino acid compositions.

Microfilm $2.00; Xerox $5.00. 99 pages.

A DIRECTING EFFECT OF INORGANIC PHOSPHATE ON THE PATHWAYS OF HEXOSE PHOSPHATE METABOLISM.

(L. C. Card No. Mic 59-3932)

Edward A. Kravitz, Ph.D.
University of Michigan, 1959

The first reaction of the hexose monophosphate shunt pathway of glucose utilization is inhibited by inorganic phosphate. In addition, this compound is an essential reactant in the Embden-Meyerhof glycolytic pathway of glucose metabolism. The possibility existed, therefore, that the intracellular level of inorganic phosphate might direct glucose metabolism through either the shunt or the glycolytic pathway. A high phosphate level should inhibit the shunt pathway and allow glycolysis to proceed, while a limiting phosphate level should have the opposite effects. To test this hypothesis, experiments were carried out with tumor cell extracts, intact tumor cells, and a reconstructed enzyme system.

Cell Extracts. Enzyme extracts were prepared from Ehrlich mouse ascites tumor cells. When either an excess of triphosphopyridine nucleotide or a system for the reoxidation of reduced triphosphopyridine nucleotide was added to these extracts, glucose was initially degraded entirely by way of the shunt pathway. If inorganic phosphate was also added to the incubation mixtures, the amount of glucose metabolized through the shunt pathway was markedly decreased and a large portion of the glucose was metabolized through the glycolytic route.

Reconstructed Enzyme System. With a reconstructed enzyme system consisting of highly purified yeast glucose-6-phosphate dehydrogenase, yeast phosphohexoisomerase, and muscle phosphohexokinase, a phosphate inhibition was demonstrated similar to the one obtained with cell extracts. The feasibility of using this system to study the effect of other chemical as well as physical factors which might influence the choice of pathway of glucose metabolism was discussed.

Intact cells. The addition of inorganic phosphate to a suspension of intact tumor cells utilizing radioactive glucose resulted in a marked stimulation of glycolysis. Glucose metabolism through the shunt pathway was not appreciably increased by the phosphate even though there was a large increase in glucose uptake. Calculations indicated that the percent of the consumed glucose metabolized through the shunt pathway was always lower when phosphate was added to the incubation mixture.

The addition of methylene blue to cell suspensions preferentially stimulated the shunt pathway, but did not reverse the phosphate effects described above. Data were discussed which indicated that the availability of oxidized triphosphopyridine nucleotide in the Ehrlich cells limited glucose metabolism through the shunt pathway.

Deoxyuridine was added to the cell suspensions in an attempt to trap intracellular inorganic phosphate. The addition of this compound, however, inhibited both pathways to the same extent. The nature of this inhibition was not readily apparent.

In general, it appeared that enzyme levels were not limiting glucose metabolism through the shunt pathway in Ehrlich mouse ascites tumor cells, while both the availability of oxidized triphosphopyridine nucleotide and the level of inorganic phosphate were capable of directing glucose metabolism through this route.

The data of this thesis support the original hypothesis that the level of inorganic phosphate is capable of directing the pathway of carbohydrate utilization.

Microfilm $2.00; Xerox $6.00. 122 pages.

STUDIES ON PHOSPHOPROTEIN PHOSPHATASE AND PHOSPHOPEPTIDES.

(L. C. Card No. Mic 59-3844)

Robert Kuttner, Ph.D.
The University of Connecticut, 1959

A phosphoprotein phosphatase previously reported in chick embryos was subjected to further investigation. This enzyme differed from mammalian phosphoprotein phosphatases by being thermolabile and having activity against phosphopeptides isolated from tryptic digests of casein. A further difference established in this study was the absence of activity against aromatic phosphoesters though a contaminating enzyme with this activity was found in the chick embryo preparation.

The specificity of avian phosphoprotein phosphatases is of great interest since this enzyme can attack phosphoseryl residues in proteins and peptides but has no action on free phosphoserine itself. The purpose of this research was to establish the structural requirements of phosphoprotein phosphatase substrates. As a preliminary step, the caseopeptide mixture was analyzed and found to consist of three peptides averaging nine amino acids each with glutamic acid residues in the N-terminal positions.

Four experimental approaches were investigated. An attempt was made to determine if enzyme activity was influenced by peptide chain length. Hydrolyzates containing phosphodipeptides were tested. These casein dipeptides were composed chiefly of glutamic acid and phosphoserine.

The second approach was designed to reveal if the N-terminal amino acids and their nearest neighbors were essential for the substrate activity of the casein "nonapeptides." The Edman reaction was used to sequentially subtract amino acids from the caseopeptides.

The third phase of the research was concerned with the apparent correlation between susceptibility to phosphoprotein phosphatase and alkali-lability. This approach was based upon the fact that all known substrates were rapidly dephosphorylated by N/4 sodium hydroxide at 37°C. Phosphoserine anhydride, an alkali-labile cyclic dipeptide of phosphoserine, was synthesized and tested with the enzyme.

The last study was to determine if glutamic or aspartic acid, common neighbors of phosphoserine in phosphoproteins, were essential for substrate abilities. Silk fibroin, a protein with a low dicarboxylic acid content, was phosphorylated and tried as a substrate.

The avian phosphoprotein phosphatase did not attack the phosphodipeptides or the phosphoserine anhydride. Activity was shown, however, against the chemically shortened tryptic caseopeptides and the phosphorylated silk fibroin.

These results indicate that phosphodipeptides have been too radically shortened to serve as substrates. On the other hand, the removal of one or two amino acids from the N-terminal positions of the casein "nonapeptides" does not destroy substrate abilities. The lack of activity against phosphoserine anhydride indicates that alkalilability, while characteristic of all known substrates, is not by itself diagnostic of phosphoprotein phosphatase substrates. The fact that phosphorylated silk fibroin was attacked by the enzyme is evidence that proximal glutamic and aspartic acid residues are not responsible for the susceptibility of phosphoseryl residues in proteins and peptides to phosphoprotein phosphatase action.

Microfilm $2.00; Xerox $4.40. 82 pages.

ASPECTS OF HEXOSAMINE METABOLISM.

(L. C. Card No. Mic 59-3942)

Joseph Murray Merrick, Ph.D.
University of Michigan, 1959

The purpose of this study is to investigate the metabolism of D-galactosamine and D-glucosaminic acid. D-galactosamine is a constituent of many complex substances found in nature. D-glucosaminic acid is not known to occur in nature, but is of interest, since it is an amino acid which is structurally related to the hexosamines. Little is known about the intermediary metabolism of either D-galactosamine or D-glucosaminic acid.

The characterization of small quantities of D-galactosamine has been hampered by the lack of suitable, stable, crystalline derivatives, which adequately differentiate this sugar from D-glucosamine. The present study describes the preparation of N-carbobenzyloxy-D-galactosamine. This derivative differs in melting point from the D-glucosamine derivative and can be used for identification purposes. The method of preparation is applicable to small quantities of D-galactosamine, and may be useful for the preparation of other water-soluble N-carbobenzyloxy derivatives.

As an aid in studying the intermediary metabolism of D-galactosamine, certain related compounds were prepared for enzyme studies. Since the phosphate esters are known to be the principal intermediary metabolites of D-glucosamine, D-galactosamine 6-phosphoric acid was prepared. This compound was obtained in crystalline form and was characterized by elementary analysis and by periodate oxidation studies.

Since D-galactosamine generally exists in nature as the N-acetyl derivative, it was of interest to prepare N-acetyl-galactosamine 6-phosphoric acid. The chemical synthesis of this compound was successfully accomplished. The enzymatic acetylation of D-galactosamine 6-phosphate in the presence of acetyl coenzyme A was studied with extracts of Neurospora crassa and of various rabbit tissues. Previous work has shown that preparations from these sources are highly specific for D-glucosamine 6-phosphate and do not acetylate D-galactosamine, D-glucosamine, p-nitroaniline, or amino acids. However, these extracts were found to acetylate D-galactosamine 6-phosphate as effectively as D-glucosamine 6-phosphate. The Neurospora enzyme was purified over 100- fold, but the fractionation did not result in separation of the two activities. Whether the acetylation of D-galactosamine 6-phosphate and D-glucosamine 6-phosphate is catalyzed by individual enzymes was not determined.

The metabolism of D-glucosaminic acid was studied with a bacterium which utilized this sugar as the sole carbon source. Respiration studies indicated that resting cell suspensions of the organism oxidized D-glucosaminic acid and D-gluconic acid but did not consume oxygen in the presence of various other sugars. Cell-free extracts of the organism converted D-glucosaminic acid to equimolar quantities of an α-keto acid and ammonia. The α-keto acid was enzymatically prepared, crystallized as the calcium salt, and identified as 2-keto-3-deoxy-D-gluconic acid by various procedures. The enzyme which catalyzes this conversion (D-glucosaminic acid dehydrase) was purified and its properties were studied. The reaction was found to be dependent on the presence of pyridoxal phosphate and sulfhydryl compounds. Preliminary evidence suggests that 2-keto-3-deoxy-D-gluconic acid is further metabolized via its phosphorylated ester.

Thus, various derivatives of D-galactosamine were prepared as an aid in studying the metabolism of this compound. The N-carbobenzyloxy derivative can be used for its characterization, while the 6-phosphate ester is useful as a substrate for enzyme studies. The first step in D-glucosaminic acid metabolism was established as its conversion to 2-keto-3-deoxy-D-gluconic acid and ammonia.

Microfilm $2.00; Xerox $6.00. 122 pages.

A STUDY ON THE LYSINE SUPPLEMENTATION OF WHEAT GLUTEN.

(L. C. Card No. Mic 59-3589)

Edward James Middleton, Ph.D.
Rutgers University, 1959

Major Professor: Dr. James B. Allison

The effect of the supplementation of wheat gluten with lysine on growth, protein efficiency, and the lipid and

protein content of the liver and serum of normal male rats was investigated. The above criteria were employed to select a minimum level of supplementation required to bring about an optimal over-all improvement of nutritive value.

A supplementation of 300 mg of lysine per gram of wheat gluten nitrogen was required for maximum growth and protein efficiency. The feeding of 6 grams of casein nitrogen was found to produce an optimal growth response, while 8 grams of supplemented wheat gluten nitrogen were required to produce an equivalent increase in body weight. A nitrogen growth index was determined for each of the diets: casein 25, supplemented wheat gluten 17, and wheat gluten 7.

Total liver protein synthesis was shown to be proportional to the growth rate when increasing amounts of casein and wheat gluten nitrogen were fed to rats. An optimal liver protein deposition was found on an 8 gram intake of supplemented (300 mg of lysine per gram of nitrogen) wheat gluten. A similar level of protein deposition was produced, however, on an intake of 6 grams of casein nitrogen.

The feeding of wheat gluten supplemented to contain 300 mg of lysine per gram of nitrogen produced an increase in the fat content of the liver when compared to values obtained on feeding the unsupplemented wheat gluten and casein diets.

As the intake of dietary nitrogen increased, a decrease in the serum lipids of the rats fed casein was observed, however, having no effect on the serum lipids of the animals fed wheat gluten. At a nitrogen intake of 8 grams of supplemented wheat gluten (300 to 350 mg of lysine per gram of nitrogen) serum lipids were decreased significantly from the values found on the unsupplemented wheat gluten diet of comparable nitrogen intake.

The albumin/globulin ratio in animals fed 8 grams of wheat gluten nitrogen was greater than that found on a comparable intake of casein nitrogen. The supplementation of wheat gluten with 350 mg of lysine per gram of nitrogen produced a maximal albumin/globulin ratio at the 3, 6, and 8 gram intakes, exceeding the ratio for casein nitrogen at the higher intake level.

The results were discussed in relation to current knowledge on amino acid balance.

Microfilm $2.00; Xerox $5.60. 111 pages.

THE EFFECT OF HYDROCORTISONE ON THE FREE AMINO ACIDS, GROWTH, AND PIGMENTATION OF NEUROSPORA CRASSA.

(L. C. Card No. Mic 59-2979)

Saul Lewis Neidleman, Ph.D.
University of Arizona, 1959

Supervisor: A. R. Kemmerer

A study was undertaken to ascertain the suitability of Neurospora crassa as an in vivo biochemical indicator of the metabolic effects of hydrocortisone.

The organism was shown to be responsive to hydrocortisone in terms of its free amino acids, growth, carotenoids, and pigment from tryptophan, called neurosporommochrome in this research.

In order to investigate the effect of hydrocortisone on the free amino acids, the organism was grown in submerged culture in the presence (6.19×10^{-4} M) or absence of hydrocortisone acetate with a simple, synthetic medium containing various single amino acids or ammonium chloride as nitrogen sources.

Concentrations of free amino acids formed were determined by paper chromatography and, to a considerable degree, were a function of the particular amino acid provided as nitrogen substrate, for example, arginine consistently resulted in higher levels of free amino acids than proline.

Hydrocortisone acetate treatment caused free amino acid concentrations to be significantly different from control values, in many cases. In general terms, irrespective of amino acid substrate, hydrocortisone acetate caused concentrations of individual free amino acids to approach a baseline value, regardless of whether the control value lay above or below this baseline. This was referred to as the directional effect. The calculated baseline value for each free amino acid was the mean from those runs in which hydrocortisone acetate had no statistically significant effect.

While mean concentrations of individual free amino acids and ratios among the various free amino acids, irrespective of amino acid substrate, were not significantly altered by hydrocortisone acetate treatment, the dispersion of values about the mean concentration was significantly decreased for the free amino acids alanine, glycine, leucine, serine, threonine, valine, and those runs of lysine in which the amino acid substrates were alanine and arginine. In the cases of aspartic acid, glutamic acid, tyrosine, and runs of lysine with other amino acid substrates, the dispersion was not significantly decreased.

In studying the growth effect of hydrocortisone on Neurospora crassa, the method of culture was as for the free amino acid work, and growth was measured in terms of mycelial dry weight.

Hydrocortisone acetate treatment gave both inhibitory and stimulatory effects on growth of the organism, depending upon the particular amino acid substrate. Growth increases were shown with alanine, arginine, and leucine; decreases, with lysine, phenylalanine, proline, and valine. No correlation was apparent between the directional effect and growth effect of hydrocortisone acetate.

Carotenoid synthesis was increased quantitatively and possibly influenced qualitatively by treatment of the organism with hydrocortisone acetate. Treated mycelia grown on agar slants appeared red-orange in color, while controls were orange. Extraction and chromatographic procedures indicated a general increase in carotenoid synthesis and a possible qualitative effect on a hypophasic carotenoid.

Mycelia grown on slants in darkness were white to light yellow in color, while treatment with hydrocortisone acetate resulted in a dark yellow pigmentation.

Mycelia grown on slants in the presence of diphenylamine (1.5×10^{-4} M) were white, while hydrocortisone acetate treatment caused a rose-red pigmentation of mycelia in the area of inoculation.

In all of these effects of hydrocortisone acetate on carotenoid pigmentation, the hormone appeared to increase dehydrogenation.

Neurospora crassa grown in submerged culture in the presence of tryptophan, kynurenine, or 3-hydroxykynurenine, produced a dark brown pigment. Hydrocortisone acetate inhibited formation of this pigment from each of

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

these substrates. This inhibitory effect was not counteracted by niacinamide, pyridoxal, riboflavin, or thiamin.

Microfilm $2.00; Xerox $6.60. 136 pages.

MOLECULAR WEIGHT STUDIES ON ACID-PRECIPITATED, CALCIUM-PRECIPITATED, ALPHA, AND BETA CASEINS BY OSMOTIC PRESSURE MEASUREMENT IN 6.66 M UREA.

(L. C. Card No. Mic 59-2644)

Harald Christian Nielsen, Ph.D.
Michigan State University, 1957

The osmotic pressure behavior of acid-precipitated, calcium-precipitated (1), alpha, and beta caseins in 6.66 M urea buffered to pH 4.8 or 6.0 with acetate of ionic strength of 0.1 was studied in order to determine their molecular weight values.

Alpha and beta caseins were prepared by fractional precipitation from strong urea solutions according to a modification of the procedure of Hipp et. al. (2). During fractionation, urea concentrations were determined by measurement of refractive index after deproteinization with trichloracetic acid.

Osmotic pressure measurements were made at 10°, 20°, and 30° C. using both the Bull and the Fuoss-Mead osmometers; the latter was modified in order to permit the use of toluene as a manometer fluid. Solutions were analyzed for casein content before and after osmotic pressure measurement by determining their absorbance at 280 mμ.

The equilibrium osmotic pressure (P in cm. H_2O) for each measurement was arrived at by examination of a plot of osmotic pressure versus time. The equilibrium osmotic pressure was converted to its 0° value (P_o) and then divided by the corresponding protein concentration (C in gm./100 ml.) to obtain the reduced osmotic pressure (P_o/C). The results for each casein preparation were expressed in a linear plot of P_o/C versus C whose equation was determined by the method of least squares.

Molecular weight (M) values were calculated using the van't Hoff equation in the following form:

$$\left(\frac{P_o}{C}\right)_{\lim. c=o} = \frac{RT}{M}$$

in which T is the absolute temperature, and R the gas constant (848 cm. H_2O - 100 ml. per gram per degree). The results are summarized in the following table:

Calcium-precipitated casein was studied at pH 6.0 because during its isolation the protein was never exposed to hydrogen ion concentrations greater than found in skim milk. It had been proposed (1) that the high solubility and simple sedimentation pattern of this protein at neutral pH was a result of such treatment. The other caseins were examined at pH values near their isoelectric points.

The molecular weight values expressed for acid-precipitated and calcium-precipitated caseins are number averages, because these proteins are mixtures and osmotic pressure is a function of the number of molecules per unit volume. The nearly identical molecular weight values given by acid-precipitated and calcium-precipitated caseins (28,700 and 29,800 respectively) plus the very similar electrophoretic patterns they produce indicate a close resemblence between these proteins.

TABLE I

MOLECULAR WEIGHTS AND P_o/C VERSUS C EQUATIONS FOR CASEINS DISSOLVED IN 6.66 M UREA

Casein Preparation	Molecular Weight	P_o/C vs. C Equation	Meas. pH	Temp. (Deg. C.)
Acid-Precipitated	28,700	$P_o/C = 8.08 + 0.399C$	4.8	30
Calcium-Precipitated	29,800	$P_o/C = 7.78 + 0.601C$	6.0	10
Alpha	27,800	$P_o/C = 8.34 - 0.247C$	4.8	10,20,30
Beta	23,100	$P_o/C = 10.01 + 0.606C$	4.8	10,30

The negative slope observed in the P_o/C versus C plot for alpha casein suggests the possibility of aggregation with increasing protein concentration. Molecular weight was calculated from extropolation to zero protein concentration where this effect would be most diminished. Since concentrated urea solutions are regarded to have a strong deaggregating effect on proteins, the molecular weight of 27,800 for alpha casein as determined by this method is considered minimal value.

The value of 23,100 found for beta casein is also considered to be minimal again due to the deaggregating effect of urea. An axial ratio of 8.2 was estimated for this protein by substituting into the equation (3):

$$\frac{P}{C} = \frac{RT}{M} + \frac{\bar{v}\,CRT}{M}\,\frac{1}{d}$$

in which $\bar{v}$ is the partial specific volume and 1/d is the axial ratio. In this calculation it is assumed that the slope of the P_o/C versus C plot is due only to asymmetry of the protein molecules.

1. P. von Hippel and D. J. Waugh. J. Am. Chem. Soc., 77, 4311 (1955).

2. N. J. Hipp, M. L. Groves, T. L. McMeekin. J. Dairy Sci., 35, 272 (1952).

3. J. T. Edsall. In "The Proteins," H. Neurath and K. Bailey, eds., Academic Press, Inc., New York, N. Y., 1954, vol. 1, p. 595.

Microfilm $2.00; Xerox $6.00. 124 pages.

METABOLISM OF ACETATE BY HUMAN LEUKOCYTES.

(L. C. Card No. Mic 59-3649)

Edward Joseph Pastore, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Fabian Lionetti

The purpose of this investigation was to study the metabolism of normal human leukocytes. Leukocytes were incubated in vitro with C^{14}-labeled acetate, and the fate of the radioactive carbon was determined by fractionation and analysis of the major cell components.

Leukocytes were obtained from whole blood by fibrinogen sedimentation and differential centrifugation. Optimal conditions for isolation and incubation of viable cells were developed and assessed using phase microscopy for direct observation of their morphological integrity and by their oxidative metabolism. Control experiments to determine the possible effect of erythrocyte utilization of acetate were run using twice the number of cells ordinarily found in leukocyte suspensions. No utilization of acetate by red blood cells was observed.

Respiration studies were performed using standard Warburg manometry. Otherwise, incubations were carried out in modified Erlenmeyer flasks equipped with center wells for CO_2 collection and stoppered with serum bottle caps. Flasks were equilibrated and various additions were made to the suspensions using hypodermic needles. Total cells per flask varied from 1 to 5 X 10^8 with concentrations ranging from 60 to 80 X 10^6 cells per ml. of suspension. Response of respiration and combustion of acetate were directly proportional to cell number and no detrimental effects due to cell crowding were detectable within this range.

All C^{14}-containing samples were counted in a gas flow proportional counter and corrected for self-absorption. Respiratory CO_2 was collected at the termination of incubations and counted as $BaCO_3$. Hydrolysed glycogen and glucose were counted as the osazones while lipide and protein were counted as such. Other water-soluble compounds were converted to CO_2 by persulfate oxidation and counted as $BaCO_3$. Glucose was determined colorimetrically by the ferricyanide method, acetate by the lanthanum method and amino acids with ninhydrin. Glycogen was isolated by KOH digestion, ethanol precipitation and TCA purification. Glucose was isolated from Somogyi filtrates. Protein was precipitated with perchloric acid and purified by extraction with ethanol-ether. Lipides were obtained from dehydrated samples by ethanol-ether extraction. Direct isolation of fatty acids was performed by sodium ethylate saponification followed by direct extraction. Homogenates of leukocytes were prepared in a standard motor-driven unit with a teflon pestle.

Cells were shown to utilize approximately 0.5 μmoles of acetate per 10^8 cells per hour. At three hours approximately two-thirds of the substrate was in the form of CO_2 and one-third was present as non-volatile compounds. Of the latter, amino acids, mainly glutamic and aspartic, accounted for most of the activity. The activity in protein and lipide amounted to approximately 0.4 per cent of the acetate utilized. Of the lipide activity 80 per cent was in the long-chain fatty acids.

Homogenates of leukocytes were found to incorporate acetate carbon into long-chain fatty acids. This cell-free system required CoA, DPN, citrate and a glycolytic intermediate such as glucose-6-phosphate or hexose diphosphate for maximal activity. No requirements for ATP or TPN could be demonstrated. Optimal incorporation was obtained under anaerobic conditions. Fluoride inhibited the incorporation. The complete fatty acid biosynthesizing system was found to reside in the particulate-free, soluble, supernatant fraction of the homogenate.

The metabolic pattern of intact leukocytes has been compared both qualitatively and quantitatively with other mammalian tissues.

Microfilm $2.20; Xerox $7.80. 168 pages.

A STUDY ON THE EQUILIBRIUM BETWEEN CALCIUM AND PROTEIN IN RABBIT SERUM AND PURIFIED ALBUMIN SYSTEMS.

(L. C. Card No. Mic 59-3717)

Neal Alfred Peterson, Ph.D.
Stanford University, 1959

Calcium in blood serum exists primarily as protein-bound calcium and calcium ion. The equilibrium between these two forms of calcium is represented as follows:

$$CaPr \longrightarrow (Ca^{++}) + (Pr^{=})$$

and

$$(1) \qquad \frac{(Ca^{++})\,(Pr^{=})}{(CaPr)} = K$$

where (Ca^{++}) and (CaPr) are the concentrations of calcium ion and protein-bound calcium respectively, $(Pr^{=})$ is the concentration of unbound divalent protein anion, and K is the equilibrium constant for the dissociation of calcium proteinate. The purpose of these investigations was to study the effect of pH variation on this equilibrium.

Section I deals with studies made on rabbit serum. Aliquots of serum were adjusted to various pH values, and determinations were made on each aliquot for total calcium (TCa) and protein (TPr) concentrations. In addition, ultrafiltrates of the aliquots were prepared anaerobically, and the calcium concentration of the ultrafiltrates were measured. The ultrafiltrable calcium concentration represents (Ca^{++}) in equation 1. (CaPr) = TCa-(Ca^{++}), and $(Pr^{=})$ = TPr-(CaPr). The K values for each aliquot of serum were thus calculated from equation 1. A linear relationship was obtained by plotting log K against pH:

$$(2) \qquad \text{Log } K = 2.544 - 0.588\ pH$$

The experimental data indicated a linear relationship between pH and "per cent filtrable calcium." The general form of this relationship is given by

$$(3) \qquad (Ca^{++}) = -mTCa + b$$

where m and b are functions of the total protein concentration. A set of nomograms give the effect of pH on (Ca^{++}) at various total calcium isopleths, where each nomogram is specific for a given concentration of total protein. Further mathematical analysis resulted in the following linear expression for (Ca^{++}) in terms of total calcium and protein concentration, and pH:

$$(4) \qquad (Ca^{++}) = TCa\,(-0.0109\ pH \times TPr - 0.1636\ pH + 0.0537\ TPr + 2.115)$$

Equation 3 is applicable for serum total calcium concentrations between 1 and 8 mM/L, and pH values between 6.7 and 9.0.

An equation was derived which gives the change in calcium ion per unit change in pH (dCa^{++}/dpH) in terms of experimental K values, total protein and calcium concentrations:

$$(5) \qquad dCa^{++}/dpH = \left[-\frac{1}{2} + \frac{1}{2}\sqrt{\frac{(TCa + TPr + K)}{(4TCaK) + (TPr - TCa + K)^2}}\right] 0.588\ k\ \ln 10$$

Values for dCa/dpH may be computed for any TPr and TCa by substituting the empirical expression for K (equation 2) into equation 5.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Section II describes animal experiments which were performed to test equation 4. The results of these experiments indicate that equation 4 predicts the calcium ion concentration in rabbit serum with an accuracy of 0.09 mM/L.

Section III deals with a study of the equilibrium between calcium and protein on purified bovine serum albumin (BSA) and human albumin preparations. The object of these experiments was to determine the effect of pH on the equilibrium constant, and the "per cent filtrable calcium," in a system which contained calcium and a homogeneous protein species, eliminating the variables which may occur in blood serum. A refinement was achieved in the relationships derived on the purified protein system. A linear relationship between log K and pH was verified in plots where there was considerably less scattering of the data. The rate of change of K and "per cent filtrable calcium" with pH was significantly less in the system containing purified albumin. These differences were discussed in connection with the differential binding capacities of albumin and the globulins.

In Section IV, a separate consideration was given to several theoretical aspects of the dissociation of calcium proteinate. The problem of converting grams of protein into moles for application of the mass law to the equilibrium (equation 1) was discussed in detail. The experiments were reanalyzed using two methods which are available for the conversion. The empirical relationships which were derived from the data were interpreted in terms of theoretical mechanisms of the dissociation of calcium proteinate.

Microfilm $3.15; Xerox $10.80. 243 pages.

A METHOD FOR THE SEPARATION OF CHICK HEART MUSCLE CELLS FROM HEART FIBROBLASTS AND THE DETERMINATION OF THEIR GROWTH RATES ON GLASS SUBSTRATES.

(L. C. Card No. Mic 59-3595)

Clara Marie (Dodge) Refson, Ph.D.
Rutgers University, 1959

Major Professor: Dr. James Green

A method was described for the processing of chick embryo cardiac tissue in such a manner that relatively large quantities of viable cell suspensions were obtained.

A technique was discussed for the preparation of concentrated cultures of pulsating, chick heart muscle cells following the elimination of non-pulsating, fibroblast-like cells which were present in the tissue. This separation was based upon the differences in times of attachment to glass substrates which appeared to be specific for cell types. The gross distinguishing characteristics of the types of cells separated by this method were described and illustrated by photographs.

Growth curves were determined for the fibroblast-like cells and for the heart muscle cells by direct counts of whole cells from trypsinized cultures. Initially, the growth rates of the two cell strains did not differ markedly, although they were significantly different. These differences tended to vary with sub-culturing. The mean generation times of the muscle cells increased while those of the fibroblast-like cells decreased.

Microfilm $2.00; Xerox $6.40. 135 pages.

THE RELATION OF STRUCTURE TO ENZYMATIC ACTIVITY IN RIBONUCLEASE.

(L. C. Card No. Mic 59-3816)

Harold Resnick, Ph.D.
State University of Iowa, 1959

Chairman: Professor George Kalnitsky

In these studies, structural changes in relation to ribonuclease activity were investigated. The purpose was to obtain a correlation between protein configuration and biological specificity. Of immediate consideration was the relative contribution of both covalent and noncovalent forces to the integrity of the active center in this enzyme. The fundamental structures investigated were the disulfide bonds and the secondary structure in relation to enzymatic activity.

An amperometric technique for the determination of disulfide bonds was employed. The four cystine bridges were susceptible to the sulfitolysis reaction only in the presence of urea. The experimental evidence further indicates that one disulfide bond may be cleaved with little, if any, loss in activity; with the cleavage of two disulfide linkages, enzymatic activity is retained up to approximately 80 per cent. The total cleavage of all four cystine bridges does not necessarily result in complete loss in activity except where the urea concentration is high. With the cleavage of 3.9 disulfide bonds, in 6 M urea, 27-37 per cent of the original activity can still be detected. This would seem to reflect on the ability of the secondary structure in the protein molecule to maintain an active configuration. The complete loss in catalytic properties, therefore, depends not only on the reduction of disulfide bonds, but also on the subsequent alteration of the secondary structure. The results obtained were almost identical for both native and the "A" fraction of ribonuclease.

The secondary structure of ribonuclease in relation to activity has been investigated by the use of an organic-aqueous mixture, as well as, an aqueous system. In a chloroethanol-water mixture, wherein the protein molecule exhibits maximum unfolding, the activity of ribonuclease decreases by 50 per cent. In the aqueous system, measuring activity as a function of temperature, the enzymatic reaction exhibits a critical temperature range, corresponding to the range in which there is a change in configuration of the enzyme protein molecule. The activation energy, calculated from an Arrhenius plot is approximately 20.5 Kcal. The thermodynamic parameters, ΔH^0 and ΔS^0 for the reversible reaction, native $\rightleftharpoons$ denatured protein, calculated on the basis of activity, were 37.1 Kcal. and 110 e.u. respectively. These values are lower than those obtained by other investigators whose calculations were based on optical rotation and viscosity measurements. The lower values may be a reflection of disorganization in a localized area or involve several distal portions of the molecule. It is therefore concluded that some portion of the secondary,

co-operative structure of the ribonuclease molecule is essential for its activity.

In an attempt to isolate an active fragment, ribonuclease was partially digested with a fungal proteinase. The rate of digestion was found to be directly proportional to the amount of alkali taken up as measured in a pH-Stat. That structurally modified, enzymatically active fragment had been obtained was demonstrated by the changes that take place in the elution patterns on Amberlite IRC-50 columns. These fragments can now be separated for further structural studies to more clearly define the nature of the active center. Microfilm $2.00; Xerox $5.20. 103 pages.

EFFECT OF GLYCOCYAMINE ON SULFUR AMINO ACID METABOLISM IN RAT LIVER SLICES.

(L. C. Card No. Mic 59-3597)

Adolfo Max Rothschild, Ph.D.
Rutgers University, 1959

Major Professor: Dr. James B. Allison

Previous work had suggested that glycocyamine (guanidino-acetic acid), when fed in conjunction with methionine, promoted changes indicative of an increased protein anabolism in experimental animals.

The effect of glycocyamine and methionine mixtures on protein metabolism in vitro was investigated by measuring their effect on the incorporation of S^{35} amino acids by the protein of rat liver slices incubated with S^{35} L-methionine, and non-radioactive DL-methionine. The uptake of S^{35} into liver protein was shown not to be the result of a physical adsorption of radioactivity on the protein, to take place by an oxygen-dependent process, to be influenced by the time of incubation and by the concentration of S^{35}-methionine in the medium.

Following a two-hour incubation period with S^{35} L-methionine and DL-methionine, both methionine and the cystine plus cysteine fraction of liver protein became labeled with S^{35}. The radioactivity of the cysteine plus cystine fraction contributed with approximately 20% to the total S^{35} content of the protein. Glycocyamine increased the incorporation of S^{35} into the protein of rat liver slices incubated with S^{35} L-methionine and DL-methionine. This effect was due to an increased S^{35} content of both the methionine and the cysteine plus cystine fractions of the protein.

Increasing the concentration of methionine in the media did not enhance the effect of glycocyamine, but tended to depress it slightly.

Glycocyamine and methionine mixtures increased the formation of creatine by rat liver slices; creatine levels were also slightly increased when liver slices were incubated with either methionine or glycocyamine alone.

When glycocyamine and methionine were present in the incubates, the formation of creatine was directly proportional to the concentration of the methionine. In the absence of glycocyamine, creatine formation was small and could not be increased by raising the concentration of the amino acid.

The evidence obtained in this work, although indirect, suggested that glycocyamine affects S^{35} incorporation, and therefore protein metabolism, by its effect on the formation of creatine, the metabolic precursor of the phosphocreatine of the tissues.

The incorporation of S^{35} from added methionine, proceeds at a faster rate in liver slices from protein depleted rats, than in normal tissue. Glycocyamine had only a slight effect on this incorporation. It was, however, able to appreciably increase the formation of creatine in the protein-depleted slices. It is postulated that a deficiency in the amino acid pool or in other requirements of the protein synthesizing apparatus of liver tissue, may be preventing glycocyamine from increasing amino acid incorporation in liver slices from protein-deficient rats, by more than a slight margin.

Liver slices from protein-depleted animals were able to incorporate part of the radioactivity of S^{35} L-methionine into the cysteine plus cysteine fraction of their protein. The presence of glycocyamine in the incubation medium did not increase the S^{35} content of this fraction.

Microfilm $2.00; Xerox $4.60. 87 pages.

PEPTIDES FROM AN ENZYMATIC DIGEST OF COLLAGEN.

(L. C. Card No. Mic 59-3426)

Ralph E. Schrohenloher, Ph.D.
University of Cincinnati, 1959

Among the products obtained upon the digestion of cattle Achilles tendon collagen by the extracellular enzymes of Clostridium histolyticum are two peptides (Peptides A and B) which give characteristic spots on paper chromatograms and appear to be present in significant quantities. The isolation and identification of these peptides were undertaken in an effort to gain additional information regarding the amino acid sequence of collagen.

Collagen digests were fractionated into a mixture containing all of Peptides A and B and a mixture of basic materials by passage over columns of Amberlite IRC-50 in the hydrogen cycle. Fractionation of the mixture containing Peptides A and B by column chromatography on alumina using an ethanol, water, and ammonia solvent did not result in peptide preparations of sufficient purity for structural analysis. However, this mixture was fractionated into satisfactory preparations of Peptides A and B by means of ion exchange chromatography on columns of Dowex 50X4 operated with sodium phosphate buffer of gradually increasing pH and constant sodium concentration. The use of sodium phosphate buffers instead of the more commonly employed sodium citrate-acetate buffers permitted the progress of the fractionations to be followed by direct paper chromatography of column fractions without prior desalting using an ethanol, water, and ammonia solvent. Although not required for the structural studies, it was desirable to find a convenient method for the separation of buffer salts from Peptides A and B. A simple column procedure based in part on ion exclusion was found applicable for this purpose and for the separation of salts from amino acids.

The amino acids in the acid hydrolysates of highly purified preparations of Peptides A and B were identified by paper chromatography and quantitated by colorimetric

ninhydrin methods after separation on Dowex 50X4 columns eluted with a sodium phosphate buffer. The structures of the peptides were determined by application of the dinitrophenyl (DNP) method for identification of N-terminal residues and the phenylisothiocyanate (PTC) method for stepwise degradation of peptides from the amino end. These studies demonstrated Peptide A to be glycylprolylalanine and Peptide B to be glycylprolylhydroxyproline. The middle and C-terminal residues of each peptide were confirmed by application of the DNP method to the identification of the dipeptide remaining after removal of the N-terminal glycine by the PTC method. The C-terminal residue of Peptide A was also identified by a method which involves decarboxylation and acetylation of the C-terminal residue.

The quantities of Peptides A and B which could be isolated from two collagen digests were determined by estimating the peptide content of the combined chromatographically pure fractions from columns operated to obtain the maximum yield. These quantities, expressed as the per cent of collagen nitrogen recovered, were 5.1 and 5.5 for Gly.Pro.Ala and 4.7 and 5.8 for Gly.Pro.Hypro. The peptides recovered each represent about 20 per cent of the proline content of the collagen.

Both of these peptides have been isolated by others from partial hydrolysates of gelatin or steer hide collagen in amounts which account for 0.4 to 1.3 per cent of the proline content of the protein. The quantities of Peptides A and B recovered from the collagen digests indicate that the Gly.Pro.Hypro and Gly.Pro.Ala sequences are of frequent occurrence in the polypeptide chains of collagen. Also, these findings support the evidence from partial hydrolysis studies that the Gly.Pro sequence is a quantitatively important linkage of proline in collagen.

Microfilm $3.05; Xerox $10.40. 235 pages.

NITROGEN METABOLISM IN PARAMECIUM AURELIA.

(L. C. Card No. Mic 59-4039)

Anthony Thomas Soldo, Ph.D.
Indiana University, 1959

Certain aspects of the metabolism of nitrogenous compounds in Paramecium aurelia were studied. The distribution of nitrogen in the organisms was found to be affected by the composition of the medium on which they were grown. Total nitrogen was essentially the same, although acid soluble nitrogen and nucleic acid nitrogen were found to be affected considerably. Acid soluble fractions of the cells were subjected to analysis by means of paper chromatography. The following substances were identified: adenine, adenosine, guanine, guanosine, hypoxanthine, histidine, aspartic acid, lysine, glutamic acid, proline and phenylalanine. Of these substances, hypoxanthine was present in the greatest concentration. Pyrimidines and xanthine, their respective ribosides and ribotides, could not be detected.

Ammonia is released into the medium in a linear fashion by both actively growing cells and "resting" cells. No urea, uric acid, creatine, creatinine or allantoin could be detected in ambient culture fluids. The enzyme urease was not present in the cells themselves. On the basis of these results, it was postulated that the Krebs-Henseleit ornithine cycle is absent in this organism and that ammonia arises primarily from the deamination of amino acids. Hypoxanthine was also found in ambient fluids of "resting" cells in addition to smaller amounts of adenine and guanine. It was postulated that hypoxanthine is a principal end product of purine metabolism. Evidence was presented that dihydrouracil may be a principal end product of pyrimidine metabolism.

An investigation of the enzymes concerned with purine and pyrimidine metabolism revealed that the following were present in P. aurelia: nucleotidases, nucleoside hydrolases and cytidine deaminase. Time-course studies were performed with various substrates and pH optima for these enzymes determined. The enzymes uricase, adenase, xanthine oxidase, adenosine deaminase and 5'adenylic acid deaminase were not present in this organism.

Purine and pyrimidine incorporation into nucleic acids was investigated by the use of radioactive tracers. Guanosine was found to give rise to nucleic acid guanine and -adenine, whereas, adenosine was incorporated into nucleic acid adenine only. Evidence of de novo synthesis of purines was implied when it was found that formate-C^{14} appeared in nucleic acid guanine and -adenine. No evidence of incorporation of glycine-1-C^{14} into nucleic acid purines was obtained. P. aurelia can interconvert cytidine and uridine and both give rise to DNA-thymine. The methyl group of thymine may be derived from formate.

The metabolism of purines and pyrimidines by P. aurelia was compared to that of other organisms. The pattern of incorporation of these substances into nucleic acids was found to be similar to that of the ciliated protozoan, Tetrahymena pyriformis. It differed from that of mammalian tissue, however.

An unusual feature of the metabolism of P. aurelia is its ability to synthesize purines de novo, although the purine derivative, guanosine, is an absolute requirement for growth in this organism. This situation was discussed from the point of view of evolution and an explanation for it, based on the concept of "loss of function," was offered.

Microfilm $2.00; Xerox $4.80. 94 pages.

THE EFFECT OF DIETARY PROTEINS ON THE SERUM LIPIDS OF NORMAL AND TUMOR-BEARING RATS.

(L. C. Card No. Mic 59-3603)

Marie Teresa Spoerlein, Ph.D.
Rutgers University, 1959

Major Professor: Dr. James B. Allison

The influence of the quantity and quality of dietary proteins on the concentration of total lipids, cholesterols, and phospholipids in the serum was studied in normal and tumor-bearing male rats of the Wistar strain. The possible role of protein depletion and amino acid imbalance on the level of serum lipids is discussed.

When normal weanling rats were fed various quantities of three proteins of different quality for eight weeks, the more balanced proteins, casein and cottonseed flour, caused a reduction in the concentration of serum lipids as the

quantity of these proteins was increased in the diet. Wheat gluten, which is exceedingly deficient in lysine, caused an elevation of the serum lipids as the per cent of this protein in the diet was raised. The biological value of the three proteins was reflected in the growth rate. Casein was the most effective in promoting growth, while wheat gluten produced the poorest body weight gain. The possible implication of significantly heavier livers from animals on wheat gluten than from those fed casein or cottonseed flour is discussed.

In rats bearing the transplanted Walker 256 neoplasm, addition of an optimal level (0.7%) of methionine or methionine plus glycocyamine to a 12% casein diet at the time of tumor transplantation improved the growth of the carcass and reduced the hyperlipemia (total lipids, cholesterols, and phospholipids) seen in tumor animals fed unsupplemented 12% casein. Feeding higher levels of casein (18%, 25%, or 35%), with or without methionine and glycocyamine, also decreased the quantity of lipids in the serum to the same degree and maintained a heavier carcass. Supplemented or unsupplemented 35% casein gave the highest nitrogen intake and caused the greatest retardation of tumor growth compared to the lower levels of dietary casein.

In R-1 sarcoma-bearing rats, the chemotherapeutic effect of methionine and glycocyamine and/or diethylenephenylphosphoramide (DPP) was determined at a time when the tumor was entering into the rapid growth phase (ten days after tumor transplantation). In this study, DPP, with or without methionine and glycocyamine, retarded tumor growth, reduced the hyperlipemia found in cancer to normal values, lowered the liver weight of tumor animals, and reduced serum albumin and total protein levels below that obtained for normal rats. Without DPP, supplementation of the 12% casein diet with an optimal level of methionine and glycocyamine (0.7%) improved carcass growth and elevated the serum albumin values in tumor bearers above that seen in animals on 12% casein alone.

Microfilm $2.00; Xerox $7.00. 150 pages.

CANCER CHEMOTHERAPY WITH 6-MERCAPTOPURINE AND THE MACROMOLECULAR STRUCTURE OF TUMOR DEOXYRIBONUCLEIC ACID.

(L. C. Card No. Mic 59-3903)

Audrey Larack Stone, Ph.D.
Cornell University Medical College, 1959

Determination of the macrostructure of deoxyribonucleic acid provides a basis for interpretation of biological events such as the genesis and chemotherapy of cancers. This study concerns physico-chemical properties (base composition, spectrophotometric titration, light scattering and viscosity) of tumor DNA under various physiological conditions resulting from cancer chemotherapy with 6-mercaptopurine (6-MP).

Deoxyribonucleic acids from untreated and treated 6-MP Sensitive and Resistant Sarcoma 180 (S 180) were compared to determine whether 6-MP therapy affects the macromolecular nature of DNA and whether development of resistance involves a difference in structure or susceptibility of tumor DNA. These tumors represent a source of DNA undergoing experimentally controlled variation in metabolism and growth and might yield information pertinent to possible physiological variation in DNA macrostructure. Studies were extended to another 6-MP sensitive tumor (Mammary Adenocarcinoma).

Several preparations of DNA from each of the following tumor groups were studied:

1. S 180 eight days after implantation
2. S 180 four days after treatment
3. S 180 growing ten days after treatment
4. S 180 regressing ten days after treatment
5. 6-MP Resistant S 180 eight days after implantation
6. 6-MP Resistant S 180 one day after treatment
7. 6-MP Resistant S 180 four days after treatment

Treatment consisted of seven consecutive daily doses initiated 24 hours after implantation. Tumor growth was inhibited in the sensitive strain. At four days tumors were static, after which tumors either regressed or resumed growth. Effects are similar in the adenocarcinoma.

Light scattering and viscosity results showed that decrease in molecular weight and change in shape of DNA from both sensitive and resistant tumors occurred after 6-MP treatment. There was no change in chemical constitution of the bulk of the DNA since the base composition was the same for all tumor groups. Spectrophotometric titration indicated that the alteration in macrostructure was not accompanied by disturbance of the native hydrogen-bonded structure.

Deoxyribonucleic acids from untreated tumors of both strains of S 180 were similar (molecular weight, 9.6 to 10.9 million; end-to-end distance, 540 to 799 mu). Effects of 6-MP on DNA structure varied with time and were greater in the sensitive as compared with the resistant strain. There was marked polydispersity of mass or shape in preparations from groups 2 and 4 and the molecules were smaller and more coiled than those from untreated tumors. The extreme depolymerization of DNA from group 3 tumors prevented isolation in the usual manner. Preparations consisted of low molecular weight DNA variably aggregated and bound to protein.

The extent of polymerization and coiling of DNA from treated resistant tumors was about one half that from untreated tumors, indicating that resistance is associated with the maintenance of a certain degree of integrity of the DNA. Conversely, changes in DNA structure without growth inhibition and the abnormal DNA in group 3 tumors support the suggestions of Biesle & Mandel that effects on DNA are not directly related to the growth inhibitory action of 6-MP.

Anti-tumor activity of 6-MP may be directly related to derangements in the mitochondria involving antagonism of Coenzyme A. Secondary effects on DNA could arise from release of DNA-ases upon mitochondrial disruption and could explain the more marked structural alterations in the sensitive as compared with the resistant strain. The lowered molecular weight and increased extension of the DNA in the latter case might have resulted from direct purine antagonism, incorporation of an abnormal metabolite or loss of activity of a polymerizing enzyme or protein.

The results emphasize the value of anti-mitochondrial agents as potential oncolytes. The variation in molecular properties of the bulk of the cellular DNA in growing S 180 tumors raises questions concerning the structure of the DNA which is involved in essential function of the cell and

possible differences in this component among normal and neoplastic tissues.

Microfilm $2.00; Xerox $5.20. 105 pages.

THE PRESENCE, ROLE, AND NATURE OF COPPER IN CYTOCHROME c OXIDASE.

(L. C. Card No. Mic 59-3608)

Christina Vander Wende, Ph.D.
Rutgers University, 1959

Major Professor: Dr. Walter W. Wainio

The role and nature of the copper in cytochrome c oxidase were studied. In a series fractionation of the insoluble heart muscle mitochondrial preparation, there was good correlation between the copper content, the 605 mμ absorption in the reduced state, and the cytochrome c oxidase activity for each fraction. With a partially purified soluble preparation of the enzyme, a linear relationship between the copper content and the activity was demonstrated.

The firmness of the copper binding was indicated in studies employing incubation and dialysis which demonstrated that high concentrations of the complexing agents and prolonged contact were essential to inhibit cytochrome c oxidase. In other experiments to determine the nature of the metal in the enzyme, it was shown that the copper is in the cuprous state, is in the non-heme fraction, and is apparently protein bound. Reactivation of preparations partially free of copper was achieved with the cuprous ion.

It appears that, regardless of the substrate used, both the heme and copper are necessary for the activity of cytochrome c oxidase.

Microfilm $2.20; Xerox $7.80. 168 pages.

THE EFFECT OF RATE OF OXYGEN TRANSFER UPON ANTIBIOTIC PRODUCTION BY A STRAIN OF STREPTOMYCES LAVENDULAE.

(L. C. Card No. Mic 59-3611)

Colin West, Ph.D.
Rutgers University, 1959

Major Professor: A. Zimmerli

An investigation of the production of the basic, antifungal antibiotic mycothricin by a strain of Streptomyces lavendulae in pilot plant equipment was carried out. The conditions of agitation and aeration for the optimal production of the antibiotics were established in five liter fermenters. These conditions were reproduced in larger scale equipment, and no loss in antibiotic production with increase in scale of fermentation was found.

It was found that low rates of oxygen transfer in the fermenter resulted in the formation of the antibiotic streptothricin, which is a member of the mycothricin complex. On increasing the rate of oxygen transfer, it was found that compounds of little antibiotic activity were formed, while, by further increasing the rate of oxygen transfer, the mycothricin complex was produced. It was demonstrated that the effect of oxygen transfer rate upon the culture was not one of selection between competing strains, but one in which the pattern of antibiotic synthesis was directed in favor of particular components of the complex formed by a single strain.

As well as the requirement for a high rate of oxygen transfer, it was shown that the application of a high rate of shear to the fermentation prevented the formation of pellets of the organism. This resulted in increased production of the antibiotic. The broth produced in this manner was highly viscous and behaved as a pseudoplastic.

Rates of oxygen transfer were varied by both the superficial velocity of the air passed into the five liter fermenters and changes in the oxygen content of the air. In shake flask fermentations paper powder was added to increase viscosity and reduce oxygen transfer. It was found that variation in oxygen transfer rate by each of these methods was reflected by a change in the composition of the antibiotic complex produced.

The capacity of the five liter fermenters to transfer oxygen was determined by the sulphite method. It was found that the antifoam agent employed in the fermentation reduced rates of oxygen transfer.

Microfilm $2.00; Xerox $6.40. 132 pages.

THE RELATIONSHIP BETWEEN RIBONUCLEASE, RIBONUCLEIC ACID, AND PROTEIN METABOLISM OF RATS.

(L. C. Card No. Mic 59-3615)

Seymour Zigman, Ph.D.
Rutgers University, 1959

Major Professor: Dr. James B. Allison

The purpose of this study is to determine the effects of depletion in protein reserves, of the growth of a tumor, and of a carcinostatic drug upon ribonuclease activity in the serum and tissues and ribonucleic acid in the tissues of rats. Depletion in reserves, the growth of a tumor, and the carcinostatic drug are all thought to reduce protein anabolism of the tissues.

Depletion of the male Wistar rats was caused by feeding a protein-free diet, or a diet containing a poor quality protein (wheat gluten), or a low quantity of protein (12% casein). The Walker 256 carcinosarcoma was transplanted into and the drug N,N'-diethylene-N"-phenylphosphoramide was injected into other groups of animals to determine the effects of these treatments on ribonuclease activity and ribonucleic acid content of the tissues. Methods were described for measuring total protein content, ribonucleic acid and desoxyribonucleic acid phosphorus contents, and ribonuclease activity of rat tissues and sera.

Severe protein depletion, produced by feeding a protein-free diet for four weeks, caused an increase of liver, kidney, and serum ribonuclease activity, a decrease of liver and kidney ribonucleic acid phosphorus content, and a decrease of liver, kidney, and serum total protein. Similar but less marked changes were induced by feeding lower quality or quantity dietary protein. The effects of a growing

implanted tumor were also similar to those reported for severe protein-depletion. However, these effects appeared early in the growth of the tumor, before the host animals were severely depleted. Injection of the drug inhibited tumor growth and caused an increase of tissue and serum ribonuclease activity, and a decrease of total protein and ribonucleic acid phosphorus content. Most notable was the increase of enzyme activity and decrease of ribonucleic acid phosphorus and total protein contents of the tumor tissue itself.

The results and supporting evidence reported uphold the hypothesis that increased ribonuclease activity in serum and tissues, due to an inhibition of protein anabolism, is responsible for a decrease in tissue ribonucleic acid content. The data also suggest that the carcinostatic activity of diethylenephenylphosphoramide is associated with the direct or indirect effect of the drug upon metabolic pathways leading to increased ribonuclease and decreased ribonucleic acid with corresponding reduction in synthesis of tumor tissue protein.

Microfilm $2.00; Xerox $4.00. 73 pages.

CHEMISTRY, INORGANIC

POLAROGRAPHY IN ANHYDROUS ETHYLENEDIAMINE.

(L. C. Card No. Mic 59-3987)

Richard Eugene Bayer, Ph.D.
Indiana University, 1959

The electrochemical behaviors of some inorganic salts in the non-aqueous solvent ethylenediamine were studied by means of current-voltage (polarographic) measurements. These behaviors may be expected to differ from those observed with aqueous solutions because of the low dielectric constant of ethylenediamine (12.5) and its ability to form stable chelate complexes with some cations.

A reversible and reproducible non-aqueous reference electrode was developed for these studies. It consists of saturated, two-phase zinc amalgam in contact with ethylenediamine containing 0.25 molar lithium chloride and saturated with zinc chloride, which is only slightly soluble in ethylenediamine. The potentials of duplicate electrodes agreed to within one millivolt and remained constant through intermittent use over a period of several months. Replicate half-wave potentials for reductions in ethylenediamine, measured against this reference electrode, agreed to within several millivolts.

Reduction potentials and diffusion coefficients of alkali metal ions and some transition metal ions were measured in ethylenediamine and compared with values obtained in aqueous solution. The relative reduction potentials in ethylenediamine are considerably different from what they are in water and correlate with varying strengths of the metal-oxygen and metal-nitrogen bonds for these ions, as reflected in the stabilities of metal-ethylenediamine complexes in water. The transition metal cations become relatively more difficult to reduce when the solvent is changed from water to ethylenediamine, whereas the alkali metal cations are relatively more easily reduced. The half-wave potentials of the alkali metal cations become increasingly more negative with decreasing atomic weight, i.e., the half-wave potentials increase regularly in the negative direction going from cesium to lithium. The diffusion coefficients of the alkali metal cations decrease regularly going from cesium to sodium when lithium chloride is used as the supporting electrolyte. In solutions containing tetra-n-butylammonium iodide, the diffusion coefficient of lithium is greater than that of sodium, presumably due to a greater degree of formation of neutral ion pairs on the part of the lithium ion.

The constants for the stepwise formation of cadmium cyanide complexes in ethylenediamine were measured and are as follows: $K_1 = 360$, $k_2 = 7.4 \times 10^4$, $K_3 = 7.4 \times 10^6$, and $K_4 = 4.1 \times 10^{8.6}$. The value of the overall constant in ethylenediamine, $10^{8.6}$, is much less than the value of the overall constant for the formation of the tetracyano cadmium complex in water, 10^{19}, due to the much greater competition of the chelate-forming ethylenediamine solvent molecules. The value of the overall constant in ethylenediamine, however, does agree reasonably well with the value calculated for the corresponding reaction in water, i.e., the replacement of ethylenediamine by cyanide in the coordination sphere of the cadmium ion. The value of the equilibrium constant for this latter reaction is given by the ratio of the overall formation constant of aqueous tetracyano cadmium complex to that of the aqueous triethylenediamine cadmium complex, and is 10^7.

These studies indicate that the electrochemical behavior of a solute in this non-aqueous solvent can be understood, explained and predicted on the basis of its behavior in aqueous solution and the structures of the solute and solvent species. Microfilm $2.00; Xerox $6.20. 126 pages.

THE PHOTOCHEMISTRY OF TRIS(ETHYLENEDIAMINE)COBALT(III) ION IN SOLUTION.

(L. C. Card No. Mic 59-3842)

Donald Lee Klein, Ph.D.
The University of Connecticut, 1959

It has been found that the tris(ethylenediamine)cobalt(III) ion undergoes photochemical decomposition in aqueous solution. The products of the reaction are cobalt(II), ammonia, formaldehyde and ethylenediamine; no oxidation of the anion was detected. Thus, this is one of the first reported photochemical reactions in which the transition metal of a complex ion is reduced by a neutral ligand.

No change in the rate of the reaction or the products was noted when different acids (HCl, HBr, H_2SO_4 and $HClO_4$) and different pH values were used for the solvent. In basic solution, the precipitation of $Co(OH)_2$ and the air oxidation of Co(II) in the presence of ethylenediamine made rate studies difficult.

The quantum yield was 0.070 with 2537 Å radiation. This wave length is within the charge transfer absorption band of the complex ion. The maximum of this absorption occurs at 2110 Å with a molar extinction coefficient of 2.12×10^4. The data indicate that the reaction involves a free radical mechanism.

Microfilm $2.00; Xerox $4.20. 78 pages.

ISOMORPHOUS SUBSTITUTION IN THE PYROCHLORE STRUCTURE.

(L. C. Card No. Mic 59-3853)

Robert Mazelsky, Ph.D.
The University of Connecticut, 1959

Phases of the pyrochlore structure having the composition $Na_{1-x}Ca_{1+x}M^{IV}_{x}Nb^{V}_{2-x}O_6F$ where M=Mo,Nb,Ti,Zr,V were prepared. Lattice parameters, $\sin^2\theta$ values, hkl values, and intensities are reported for phases. Magnetic susceptibilities and resistivity measurements are reported for the phases where M=Mo and Nb.

Phases of the compositions $NaCa_{1-x}Sr_xNb_2O_6F$, $NaCa_{1-3/2x}La_xNb_2O_6F$, $NaCa_{1-x}La_xNb^{IV}_{x}Nb^{V}_{2-x}O_6F$, $NaSr_{1-x}La_xNb^{IV}_{x}Nb^{V}_{2-x}O_6F$, and $NaCaNb^{IV}_{x}Nb^{V}_{2-x}O_{6-x/2}F$ have been prepared and X-ray data are reported.

Substitution for calcium alone results in a linear variation of lattice parameter with change in composition corresponding to the situation in which Vegard's Law is followed ideally. Simultaneous substitution for calcium and niobium results in a non-linear Vegard's Law curve. The physical data are discussed on the basis of Zener's double exchange theory. Qualitative correlation is obtained between lattice parameter, conductivity, and magnetic moment on this basis.

The appendix describes attempts to react niobium and molybdenum dioxides with the group IVA dioxides. Little reaction was observed with silicon and germanium. Oxidation-reduction was found to occur with tin and lead dioxide. Pyrochlore structures were found for compounds of the composition $Pb_{0.75}NbO_{3.25}$, $Sn_2Nb_2O_7$, and $Cd_2Nb_2O_7$. Niobium(IV) substitution for niobium(V) in $Cd_2Nb_2O_7$ was not successful excepting for small quantities. Resistivity-temperature data are shown for $CdNb^{V}_{1.99}Nb^{IV}_{0.01}O_{3.495}$.

Microfilm $2.15; Xerox $7.60. 163 pages.

A STUDY OF THE ALKALINE EARTH METAL ALKYLS.

(L. C. Card No. Mic 59-3812)

Dwight Arthur Payne, Jr., Ph.D.
State University of Iowa, 1959

Chairman: Professor R. T. Sanderson

This dissertation reports the preparation and properties of three new compounds, calcium dimethyl, strontium dimethyl and barium dimethyl. Evidence of organo-compounds of these metals had been known since 1905, but no such compound had been isolated and characterized, except for some complexes with organo-zinc compounds until the present work.

Finely divided calcium, strontium and barium react readily with methyl iodide in anhydrous pyridine in an inert atmosphere. The reaction mixture quickly becomes highly colored and insoluble solid products precipitate from solution. These solids are apparently pyridine complexes containing both methyl and iodine attached to the metal, of composition dependent upon the experimental conditions. Refluxing, followed by prolonged extraction of the solids with fresh pyridine, reduces the iodine content leaving ultimately the dimethyl metal compound as an insoluble residue. Pyridine separates readily from all three dimethyl compounds when the solids are evacuated at room temperature. Analyses of the dry solids were carried out by hydrolysis of 10-100 mg. samples and then measurement of the evolved methane and standard gravimetric determinations of both metal and iodine. Calculated for $Ca(CH_3)_2$: Ca, 57.2; CH_3, 42.8. Found: Ca, 58.5, 57.8; CH_3, 42, 40; I, 1.9, 1.4, 1.7. Calculated for $Sr(CH_3)_2$: Sr, 74.5; CH_3, 25.5. Found: Sr. 72.7, 74.2, 73.3; CH_3, 23, 22; I, 3.5, 3.2. Calculated for $Ba(CH_3)_2$: Ba, 82.0; CH_3, 18.0. Found: Ba, 81.6, 78.8, 79.1; CH_3, 17, 18; I, 2.6, 2.5. If one assumes the residual iodine, which seems impossible to remove even by very prolonged extraction, to be present as the metal iodide, the dimethyl compounds appear to be of better than 95% purity.

These compounds are all pale in color and might well be white but for the residual iodide. They undergo no visible change in vacuum below 400°, above which darkening occurs. All three hydrolyze very rapidly, and promptly become incandescent when exposed to oxygen or carbon dioxide. Microfilm $2.00; Xerox $7.00. 149 pages.

PREPARATION AND CHARACTERIZATION OF SOME TERNARY OXIDES OF THE PLATINUM METALS.

(L. C. Card No. Mic 59-3861)

John James Randall, Jr., Ph.D.
The University of Connecticut, 1959

While a very large number of ternary oxides have been prepared containing a transition metal ion as a constituent, only a very few of these contain a platinum metal ion. For this reason, the interaction of the alkaline earth oxides with the platinum metal oxides was studied, in the hope that new compounds of chemical and physical interest could be prepared. Three general types of compounds, ABO_3, A_2BO_4 and A_4BO_6, were obtained by the reaction between alkaline earth oxides or carbonates with platinum metals or their oxides. Reactions were carried out in air at temperatures from 800° to 1500°C.

ABO_3 type compounds were obtained when A = Ca, Sr or Ba and B = Ru. The calcium and strontium compounds have distorted perovskite type structures and are both orthorhombic. The barium compound has a hexagonal structure which does not appear to be related to the perovskite type structure. It was found possible to substitute Ir for Ru in $SrRuO_3$ from 0 to 50 mole percent. The orthorhombic structure is maintained through this range.

Two A_2BO_4 type compounds were obtained which evidently have the K_2NiF_4 type of structure. These compounds were Sr_2RuO_4 and Sr_2RhO_4. Intensities were calculated for the ruthenium compound and agreement with observed intensities was good. The rhodium compound was not obtained in a pure state, but lines due to the K_2NiF_4 phase were picked out from a photograph which showed the presence of another phase.

Three 4:1 compounds were prepared, Sr_4PtO_6, Sr_4IrO_6 and $Sr_4RhO_{(6-x)}$. Analytical data showed the rhodium preparation to contain Rh^{+3} and Rh^{+4} and thus it is oxygen deficient. Single crystals of the rhodium phase prepared

using an SrF_2 flux in a platinum crucible were shown to contain a large amount of platinum. Weissenberg single crystal X-ray photographs were used to determine the structure of the crystals. They were found to have a rhombohedral structure and belong to space group $R\bar{3}c$.

The structure may be described as strings of BO_6 octahedra connected by strontiums. These strontiums are surrounded by oxygens in an approximately trigonal prism arrangement. These chains of coordination polyhedra are held together by strontiums in eight-fold coordination with oxygen. No violations of Pauling's electrostatic valence rule were observed. This structure is very similar to that of K_4CdCl_6. Microfilm $2.00; Xerox $5.20. 101 pages.

STUDIES ON THE NATURE OF METAL TO SEMICONDUCTOR ALLOY JUNCTIONS.

(L. C. Card No. Mic 59-3724)

John Louis Sprague, Ph.D.
Stanford University, 1959

The purpose of this dissertation was to study the general nature of alloy junctions used to make semiconductor devices. This was done by investigating the fusion of Indium to Germanium, Indium to Silicon, and Aluminum to Silicon.

It was found that Indium will alloy directly to Germanium, and Aluminum to Silicon, in oxidizing, inert, or reducing atmospheres. On the other hand, Indium will not fuse to Silicon under any of these conditions. Further, Indium will reduce Germanium Dioxide, and Aluminum Silicon Dioxide, at elevated temperatures. However, under similar conditions, Indium will not reduce the Silicon oxide. Since, under normal conditions, Silicon and Germanium crystals are always covered with a thin oxide layer, this indicates that perhaps the greatest deterrent of successful metal to semiconductor fusion is the surface oxide on the latter.

It was found further that if this oxide was removed chemically prior to alloying, then Indium could also be fused to Silicon. This was accomplished, under carefully controlled conditions, by heating the semiconductor crystal in the presence of Carbon and Chlorine just prior to fusion, the oxide layer being removed as Silicon Tetrachloride. The formation of a reaction product of Hydrous Silica, due to hydrolysis of the tetrachloride, at the Indium-Silicon interface tended to interfere with the process, however, making the formation of uniform junctions difficult.

Light-reflection studies were also made of the recrystallization in the pits formed when metals were fused to single crystal semiconductor wafers oriented along different crystal planes, in particular the (111), (100), (211), (311), and (511). The recrystallized faces showed that, whatever the orientation of the fusion surface, the densely populated (111) plane has the greatest restricting influence to penetration of the lattice by the molten metal during fusion, and recrystallization also occurs to the greatest extent by layerlike deposition of new (111) planes over the terminal ones. However, in some cases, other faces, (111)-(111) twin boundaries, and some multiple twin aggregates also appear.

Finally, the electrical characteristics of the excellent planar junctions formed when Aluminum and Silicon are alloyed were investigated. Appropriately formed p-n junctions showed good rectification properties, except for some non-saturation of the forward current, possibly due to poor lead attachment. However, the waveforms of Silicon-Aluminum p-n-p alloy junction transistors made in the laboratory showed poor current amplification factors, due to the difficulty in getting a narrow enough base region between emitter and collector.

It was concluded that, once the surface oxide is removed, the alloying process should be essentially the same for different metals and semiconductors, except as modified by the shape of the appropriate phase diagrams, and should involve: 1) dissolution of the semiconductor crystal by the molten metal until saturation is reached; 2) some diffusion of impurity atoms into the crystal during heating; and 3) recrystallization of the dissolved semiconductor upon cooling, partially as a single crystal extension of the original lattice, and partially as small single crystals in the cooling metal. Further, (111) oriented semiconductor wafers appear best suited for the formation of devices where one wishes opposite and parallel emitter and collector junctions, while a heating cycle of a rapid temperature rise, a somewhat extended time at the fusion temperature, and a slow cooling rate should give the desired type of junctions. Finally, it was concluded that the alloying method seems best adapted for use in making Germanium devices, or Silicon devices, such as diodes, where a critically thin base region is not involved.

Microfilm $2.00; Xerox $6.80. 143 pages.

CHEMISTRY, ORGANIC

PART I-STEREOSPECIFIC POLYMERIZATION OF STYRENE. PART II-COPOLYMERIZATION OF STYRENE WITH HETEROGENEOUS CATALYSIS.

(L. C. Card No. Mic 59-3616)

Frank S. Ang. Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: C. G. Overberger

PART I

The purpose of this earlier work was to prepare crystalline isotactic polystyrene. Natta initially published the preparation of crystalline polypropylene, poly-1-butene and polystyrene and described their physical properties without initially disclosing their methods of preparation. In view of the prior disclosure of the "Ziegler Catalyst Systems" for the revolutionary low pressure polymerization of ethylene to highly linear, crystalline product, it was strongly suspected that any search for the catalyst system for the preparation of crystalline polystyrene should be channeled in the direction of the Ziegler catalyst. Subsequently, various patents and publications confirmed this conclusion. Various attempts with the use of several Ziegler catalyst systems are described which led to a successful preparation of crystalline polystyrene.

Though crystalline polystyrene was prepared, the yields

were extremely low. Several reaction variables were investigated in order to raise the yield. The catalyst systems investigated were primarily triisobutyl aluminum-titanium tetrachloride and triisobutyl aluminum-titanium trichloride. For the first system it was found that a coarse catalyst product increased the yield and also that the addition of lithium aluminum hydride as catalyst promotor enhanced the yield of crystalline polymer. For the second catalyst system it was found that catalyst activity was enhanced by a) preheating the catalyst components, b) use of a non-swelling solvent, c) stepwise addition of monomer, and d) stepwise addition of triisobutyl aluminum.

PART II

The copolymerization of styrene and p-methylstyrene with the "Ziegler-Natta" catalyst system resulted in an amorphous product. From a study of their molecular weight and copolymer composition distribution, evidence was obtained to demonstrate that the products were copolymers. Additional evidence for a copolymer was obtained by comparing the properties of these products with those of a known mixture of the two homopolymers. Determination of the relative reactivity of styrene and p-methylstyrene show them to have about equal reactivity in this catalyst system ($r_1=1 \pm 0.12$); ($r_2= 1 \pm 0.12$).

Analysis of the copolymer composition distribution indicated the presence of more than one type of copolymer suggesting a polyactivity of the catalyst system. The results are best explained by the assumption that at least two different types of copolymers are being formed. The copolymerization of styrene and p-t-butylstyrene failed to give appreciable copolymer, instead, from the observed crystallinity of the polystyrene and composition distribution, it was apparent that the product largely contained a mixture of the two homopolymers. The same results were obtained from the copolymerization of styrene and p-n-butylstyrene.

It is tentatively concluded that the reactivity of the monomer is influenced strongly by its tendency to be coordinated on the catalyst sites and that the steric and polar factors responsible for this equilibrium will be different than these same factors which are responsible for the reactivity of monomers in solution in free radical and ionic catalyzed polymerization.

Microfilm $2.00; Xerox $4.60. 86 pages.

A STUDY OF THE ALKYLATION OF THIANAPHTHENE.

(L. C. Card No. Mic 59-3832)

Stanley Frank Bedell, Jr., Ph.D.
The University of Connecticut, 1959

A survey of the published work on the reactions of thiophene (bromination, nitration and acylation) shows that an incoming group is usually directed to the 2-position. Alkylation, however, may give as high as 41% of the 3-isomer in the monoalkylate.

Thianaphthene on the other hand substitutes mainly in the 3-position and in some cases (bromination and nitration) almost exclusively in that position.

In the present work, alkylation of thianaphthene with an isopropyl group was found to occur when hydrogen fluoride, aluminum chloride (in carbon disulfide), aluminum bromide (in carbon disulfide), boron trifluoride etherate, boron trifluoride, sulfuric acid and phosphoric acid were used as catalysts. The yields of monoalkylate increased in the order of the catalysts mentioned. The alkylating agent had a marked influence on the yields as well and increased in the order halide, alcohol and olefin. In all cases where the alkyl halide was the alkylating agent little or no alkylation occurred. Under varying experimental conditions, the percentage of 3-isopropylthianaphthene present in the monoalkylate ranged from 10-25%. This result is certainly not in agreement with the expected results.

A proposal by Brown and Nelson (1953)[1] for the meta-orientation observed during the alkylation of toluene has been found to be a reasonable explanation for the 3-orientation observed during the alkylation of thiophene. This proposal, which is based on the high activity (energy content) of the isopropyl carbonium ion, may also be used as a partial explanation for the 2-substitution observed in the alkylation of thianaphthene. In short, the high energy content of the attacking species may permit the attainment of a higher energy transition state (less stable intermediate).

The alkylation of thianaphthene with olefins can be explained on the basis of the theory of Meisel, Johnson and Hartough who postulate the addition of a proton to the structure which contributes most heavily to the resonance hybrid of the molecule. The olefin then adds to the carbonium ion which is formed. Subsequent rearrangement of the new carbonium ion formed by this addition gives the 2-isomer. Microfilm $2.00; Xerox $5.60. 114 pages.

1. Brown, H. C., and Nelson, K. L. Abstracts, Division of Organic Chemistry, American Chemical Society Meeting, Los Angeles, Calif., March 1953.

MECHANISM OF THE WILLGERODT REACTION.

(L. C. Card No. Mic 59-3990)

Glenn Allen Berchtold, Ph.D.
Indiana University, 1959

It has been established that the carbonyl group is readily isomerized under modified conditions of the Willgerodt reaction, and it is believed that this carbonyl isomerization is the route by which the active functionality reaches a terminal methyl group before it undergoes irreversible oxidation to a carboxamide.

A kinetic study was made of the isomerization of 1,3-diphenyl-2-propanone to 1,3-diphenyl-1-propanone under various conditions. The progress of the reaction was followed by infrared measurement of the concentration of conjugated and nonconjugated carbonyl. When the isomerization is studied in 20 percent water - 80 percent morpholine, it is observed to be a reversible reaction; when either ketone is used as the starting material, an equilibrium mixture consisting of 25 percent, 1,3-diphenyl-2-propanone and 75 percent 1,3-diphenyl-2-propanone is formed. The isomerization is first-order with respect to ketone. The reaction is dependent on the concentration of elemental sulfur, but no order in sulfur was established.

Sulfur apparently acts as a catalyst in the over-all isomerization. The half-life for the disappearance of 1,3-diphenyl-2-propanone in 20 percent water - 80 percent morpholine containing 0.400 g.-atom per liter of sulfur is 10.9 hours at 99.59° C.

When the isomerization is studied in anhydrous morpholine, the over-all carbonyl concentration rapidly decreases. There exists at equilibrium a mixture consisting of 35 percent 1,3-diphenyl-1-propanone, 17 percent 1,3-diphenyl-2-propanone and 48 percent intermediates. The intermediates can readily be converted to the two ketones by the addition of water. The isomerization under anhydrous conditions is first-order in ketone. Sulfur, again, appears to act as a catalyst in the over-all isomerization. The half-life for the disappearance of 1,3-diphenyl-2-propanone in anhydrous morpholine containing 0.400 g.-atom per liter of sulfur is 3.1 hours at 99.59° C.

Since the Willgerodt reaction appears to proceed by this carbonyl isomerization followed by oxidation, previously postulated intermediates were subjected to the conditions of the carbonyl isomerization. 1,3-Diphenyl-2-propanol, 1,3-diphenyl-2-propanthiol, 1,3-diphenylpropene and 1,3-diphenylpropyne either did not form ketone under conditions of the isomerization or formed ketone at a slower rate that the isomerization of the ketone itself, thereby eliminating the possibility of such intermediate forms in the isomerization under the conditions studied.

The isomerization is believed to occur by way of an α-mercaptoketone intermediate, and mechanisms consistent with the observed data are proposed. Suggested intermediates were subjected to the conditions of the Willgerodt reaction and were found to give the normal product of the reaction.

Methyl substituted cyclohexanones on treatment with sulfur and morpholine were found to yield 2,5(N,N'-dimorpholino)toluene, a reaction consistent with that previously observed for cyclohexanone. The mechanism of the carbonyl isomerization is extended to explain the behavior of the cyclohexanones and the tetralones under conditions of the Willgerodt-Kindler reaction.

Microfilm $2.00; Xerox $6.00. 123 pages.

PREPARATION OF SOME B-NORSTEROIDS.

(L. C. Card No. Mic 59-4332)

Ernest Capstack Jr., Ph.D.
Brown University, 1959

A series of compounds having the basic B-norcholestane-6-carboxylic acid ring system have been prepared by a method involving cleavage of the 5,6-double bond of the cholesterol nucleus to form a condensable intermediate. Condensation occurs with ring contraction.

The 5,6-glycols and 5-ol-6-ones of cholesterol were found unsuitable as intermediates for B-norcholestanes because of the failure of the trans glycol and 5-ol-6-one to undergo cleavage and because of the unavailability of the more reactive cis isomer.

Condensation of methyl 3-acetoxy-5,6-secocholestan-5-one-6-oate yielded methyl Δ^3-B-norcholesten-5-ol-6-carboxylate. Subsequent transformations produced methyl $\Delta^{3,5}$-B-norcholestadiene-6-carboxylate, methyl B-norcholestan-5-ol-6-carboxylate, methyl Δ^5-B-norcholestene-6-carboxylate and methyl 5-acetoxy-B-norcholestane-6-carboxylate.

Methyl Δ^3-B-norcholesten-5-ol-6-carboxylate was shown to be a B-norsteroid by conversion to the known hydrocarbon, $\Delta^{3,5}$-B-norcholestadiene.

Methyl Δ^3-5,6-secocholestan-5-one-6-oate was proposed as an intermediate in the condensation of methyl 3-acetoxy-5,6-secocholestan-5-one-6-oate to methyl Δ^3-B-norcholestan-5-ol-6-carboxylate. This substance was prepared and found to behave in the same manner as the 3-acetoxy compound in the condensation reaction.

The series of B-norcholestanes made here were related to those of Woodward and Clifford (19) by conversion of the Δ^5-B-norcholesten-3-ol-6-carboxylic acid into methyl $\Delta^{3,5}$-B-norcholestadiene of this series.

Microfilm $2.00; Xerox $3.60. 62 pages.

PREPARATION OF VINYL SUBSTITUTED DICARBOXYLIC ACIDS.

(L. C. Card No. Mic 59-3875)

Robert A. Clendinning, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: William H. Rauscher

An attempt has been made to synthesize 4-vinylphthalic acid, 5-vinylisophthalic acid, 1-(4-carboxyphenyl)butadiene, and 1-(3,4-dicarboxyphenyl)butadiene. Although these pure compounds were not isolated and characterized, several interesting intermediates have been prepared and several known compounds synthesized by new methods.

The known dimethyl 4-aminophthalate was synthesized in high yield by the application of a catalytic hydrogen transfer reaction to dimethyl 4-nitrophthalate. Diazotization, followed by reaction with acrylonitrile and hydrolysis afforded 3,4-dicarboxycinnamic acid, a new compound. Reduction to the previously unknown 3,4-dicarboxyhydrocinnamic acid was accomplished in quantitative yield by catalytic hydrogen transfer. Reaction of 3,4-dicarboxyhydrocinnamic acid with N-bromosuccinimide followed by treatment with sodium carbonate gave a small amount of impure material which is believed to be 4-vinylphthalic acid. Hydrocinnamic acid was converted to styrene using this procedure with both sulfuryl chloride and N-bromosuccinimide.

The synthesis of 1-(4-carboxyphenyl)butadiene and 1-(3,4-dicarboxyphenyl)butadiene was accomplished by treating the appropriate diazonium salt with butadiene followed by reaction with potassium hydroxide. Slightly impure products were obtained.

The known dimethyl 5-nitroisophthalate was synthesized by direct nitration of dimethyl isophthalate. Reduction to the known amine was accomplished in high yield by catalytic hydrogen transfer. Diazotization, followed by reaction with acetaldoxime and hydrolysis, yielded the known 5-acetylisophthalic acid. 4-Acetylbenzoic acid, a known compound, was also synthesized by this method. Reduction of 5-acetylisophthalic acid to 1-(3,5-dicarboxyphenyl)ethanol, a new compound, and of 4-acetylbenzoic acid to 1-(4-carboxyphenyl)ethanol, a

known compound, was accomplished with sodium borohydride. Microfilm $2.00; Xerox $5.80. 119 pages.

A STUDY OF THE ENTRAINMENT METHOD OF PREPARING GRIGNARD REAGENTS.

(L. C. Card No. Mic 59-4105)

Dorotha Beatrice Cowan, Ph.D.
Vanderbilt University, 1959

Supervisor: Dr. D. E. Pearson

A study of the entrainment method for preparing Grignard reagents was made. A modified entrainment method was developed by which Grignard reagents of unreactive halides or those that coat the surface of magnesium may be prepared in yields comparable to those obtained from more active halides by the regular Grignard reaction. Several modifications in the classical entrainment procedure were made.

A new entrainer, ethylene bromide, was investigated and found to be comparable to the classical ethyl bromide and superior to it in some respects since it does not form an extraneous Grignard reagent, and its by product, $MgBr_2$, is known to be an activator of Grignard reactions. A correlation between the contact time of entrainer with the ethereal mixture of magnesium and unreactive halide and the production of desired Grignard reagent was noted. As the contact time was increased, a corresponding increase in yield of Grignard reagent was observed. Thus, a slow rate of addition of entrainer (12 to 24 hours) was used. Another modification made in the procedure was the addition of the unreactive halide to the magnesium at the beginning of the reaction. By this method the greatest concentration of unreactive halide on the active surface of the magnesium was maintained at all times. With the combined application of these modifications, the writer was able to prepare Grignard reagents of all inactive halides investigated. The yields obtained, utilizing this modified entrainment procedure, were double in all cases and sometimes treble the yields previously reported by various investigators.

The first unreactive halide investigated was α-chloronaphthalene. A 66% yield of α-naphthylmagnesium chloride was obtained based on comparison to naphthalene, and a 37% yield of α-naphthylmagnesium chloride was obtained based on conversion to α-naphthoic acid, m.p. 158-160°. The α-naphthylmagnesium chloride was also recovered in 50% yield as α-naphthylphenyl ketone, m.p. 74-74.5°. The next halide investigated was hexachlorobenzene. A 71% yield of pentachlorophenylmagnesium chloride was obtained based on conversion to pentachlorobenzoic acid, m.p. 204-208°. A 30% yield of pentachlorophenylmagnesium chloride was obtained based on conversion to pentachloroacetophenone, m.p. 89-90°. The third halide investigated was p-bromo-N,N-dimethylaniline because of its tendency to coat the surface of magnesium. A 70% yield of p-N,N-dimethylphenylmagnesium bromide was obtained based on conversion to N,N-dimethylaniline. A 48% yield of p-N,N-dimethylphenylmagnesium bromide was obtained based on conversion to p-N,N-dimethylaminobenzoic acid, m.p. 235.5-237°. The modified entrainment method was applied to unsymmetrical hydrazones and azines of halogenated ketones without marked increases in yield over those obtained by the classical method of entrainment. The method appears to be general for unreactive aryl halides and those which coat the surface of magnesium.

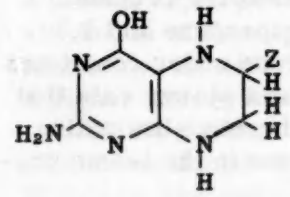
Microfilm $2.00; Xerox $4.60. 87 pages.

PYRIDINE ANALOGS OF TETRAHYDROPTEROIC ACID.

(L. C. Card No. Mic 59-3693)

Roy Charles De Selms, Ph.D.
Stanford University, 1959

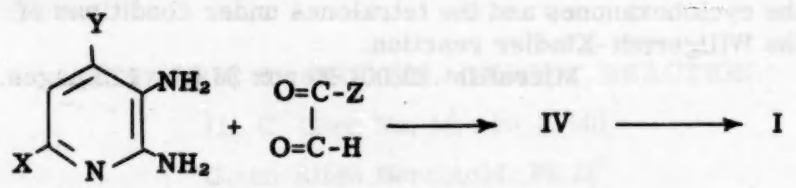
It was the purpose of this investigation to synthesize the pyridine analogs (I) of tetrahydropteroic acid for biological testing as possible anticarcinogens.



I

Z = CHO, $CH(OEt)_2$, CH_3, CH_2OH, COOH, $COOCH_3$, $CONH_2$, $CONEt_2$, CH_2NH_2, $CH_2NHCOCH_3$, CH_2NHCHO.

The following general method of approach to the problem was studied: preparation of appropriately substituted 2,3-diaminopyridines (II), condensation of that with an α-ketoaldehyde (III) or similar type compound to form derivatives of 1,4,5-triazanaphthalene (IV), and selective reduction or hydrogenation of IV to yield the desired compounds represented by I. A variety of routes to the compounds represented by II were investigated until a satisfactory one was found.

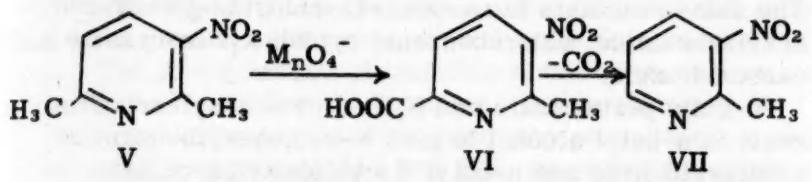


II III IV I

X = NH_2, $NHCOCH_3$
Y = OH, OCH_3, Cl
Z = any functional group

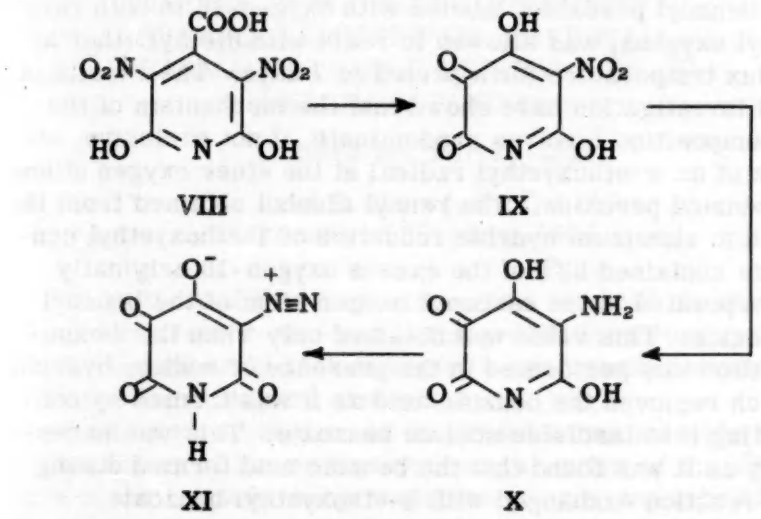
a. Although various aromatic nitro compounds have been aminated in basic solution, several attempts to aminate 2-amino-3-nitropyridine, 2-amino-5-nitropyridine, 4-nitropyridine-N-oxide, 2-nitropyridine, 4-nitropyridine, pyridine-3-sulfonic acid, and 2(β-naphthyloxy)-5-nitropyridine by the same method failed. In this connection a new synthesis of 3-nitropyridine was investigated. 3-Nitro-2,6-lutidine (V) was prepared by an improved procedure of the nitration of 2,6-lutidine. An attempt to oxidize this with permanganate to 2,6-dicarboxy-3-nitropyridine gave instead a new compound, 6-carboxy-2-methyl-3-nitropyridine (VI). This intermediate was decarboxylated to the known 2-methyl-3-nitropyridine (VII), and its structure was thus confirmed. This constitutes a superior method for the synthesis of VII.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.



V VI VII

b. Two routes starting with citrazinic acid were studied. Although these routes proved unsatisfactory, some interesting results were obtained. It was found that 4-carboxy-2,6-dihydroxy-3,5-dinitropyridine (VIII) was converted partially to 4,6-dihydroxy-2,3-dioxo-5-nitrodihydropyridine (IX) during the nitration of citrazinic acid. The reduction product of IX, 5-amino-4,6-dihydroxy-2,3-dioxodihydropyridine (X), was converted by treatment with nitrous acid to the new 3-diazo-2,4,5,6-tetraoxopiperidine (XI).

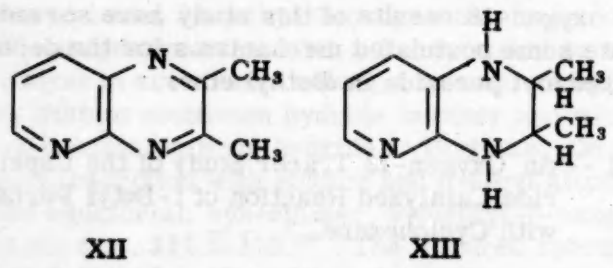


VIII IX XI X

c. Two approaches starting with chelidamic acid were studied. The route described by Gorton and Shive,[1] which had been investigated on a micro scale prior to this publication, was found to be unsatisfactory due to low yields and complications of competing reactions. The route described by Markees and Kidder[2] to obtain 4-chloro-2,3,6-triaminopyridine gave satisfactory results.

Attempts to condense 4-chloro-2,3,6-triaminopyridine with 2-bromo-3,3-diethoxypropional-1 and 2,3-diaminopyridine with fructose failed. The failure of similar unsymmetrical condensing agents to condense with a series of substituted 2,3-diaminopyridines was also confirmed by Leese and Rydon.[3]

A study of the selective reduction of the 1,4,5-triazanaphthalene system was undertaken. 2,3-Dimethyl-1,4,5-



XII XIII

triaza naphthalene (XII) was reduced selectively by lithium aluminum hydride in ether to the new 2,3-dimethyl-1,2,3,4-tetrahydro-1,4,5-triazanaphthalene (XIII). This study demonstrated the feasibility of the selective reduction of the 1,4,5-triazanaphthalene system once the appropriate starting material could be obtained.

Microfilm $2.00; Xerox $4.60. 89 pages.

1. B. S. Gorton and W. Shive, J. Am. Chem. Soc., 79, 670 (1957).

2. D. G. Markees and G. W. Kidder, J. Am. Chem. Soc., 78, 4130 (1956).

3. C. L. Reese and H. N. Rydon, J. Chem. Soc., 305 (1955).

THE KINETICS OF THE HYDROGEN EVOLUTION REACTION OF 1-HYDROXYALKYL ALKYL PEROXIDES.

(L. C. Card No. Mic 59-3696)

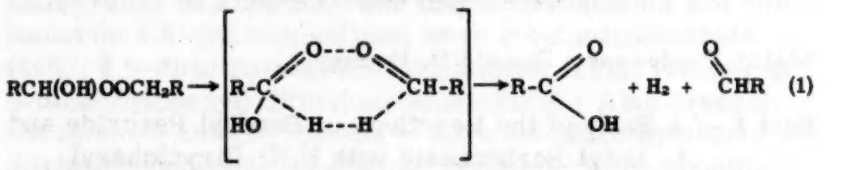
Lois Jean Durham, Ph.D.
Stanford University, 1959

A study of the thermal decomposition of primary alkyl hydroperoxides, which give hydrogen and an acid as principal products, led to the preparation and decomposition of 1-hydroxyalkyl alkyl peroxides. These compounds were postulated as intermediates in the hydroperoxide decomposition.

The kinetics of the thermal decomposition of 1-hydroxy-n-butyl n-butyl peroxide and 1-hydroxy-iso-butyl iso-butyl peroxide were studied in α-methylstyrene which served as a solvent and as a trap to catch any free radicals formed before they formed gas. The reaction was followed by the evolution of gas which was 95% or more hydrogen.

The reaction was found to obey first order kinetic laws to at least 60% reaction and in some cases to 90% reaction in individual experiments. However, a ten-fold change of concentration was found to produce a two-fold change in the observed rate constant at constant temperature. This deviation was attributed largely to a solvent effect in the relatively concentrated solutions used (0.5 to 5 molal), although other possible causes were considered. This concentration effect was minimized by using constant concentrations for studying the effect of temperature. The Arrhenius energy of activation (ΔE_a) and the enthalpy of activation ($\Delta H^{\ddagger}$) were determined graphically from plots of log k vs. 1/T and log k/T vs. 1/T respectively. The corresponding Arrhenius frequency factor (A) and entropy of of activation ($\Delta S^{\ddagger}$) were calculated. The free energy of activation ($\Delta F^{\ddagger}$) was calculated from the enthalpy and entropy of activation. These results are summarized in Table I.

Although the decomposition of 1-hydroxyalkyl alkyl peroxides is complicated by the presence of more than one reaction, the reaction yielding acid, aldehyde, and molecular hydrogen has been well established. The kinetic data obtained here as well as previous studies of the products formed are all in accord with the postulated unimolecular cyclic concerted mechanism (Eq. 1).



(1)

To date no other mechanism has been proposed which explains all of the facts.

This mechanism may be extended to the alkyl hydroperoxides by pointing out that small amounts of aldehyde

TABLE I

Summary of Data Obtained from Kinetic Studies

Cpd.[a] and Conc.	Temp. °C.	kx10^5 sec.$^{-1}$	ΔE_a[b] kcal./mole	A[c] sec.$^{-1}$	$\Delta H^{\ddagger}$[d] kcal./mole	$\Delta S^{\ddagger}$[e] cal./mole°	$\Delta F^{\ddagger}$[f] kcal./mole
iso	79.4	2.0	20.0	5.1x10^7	19.0	-27.0	28.5
0.5 M	99.4	8.86	.....	4.7	....	-27.2	29.1
	109.9	19.3	.....	4.9	....	-26.9	29.3
	110.0	20.2	....	5.1	....	-26.8	29.3
iso	79.4	4.41	21[g]	10^{9}[g]	21[g]	-21[g]	28[g]
5.0 M	99.4	26.5	....	...	....	-21	28
	109.6	54.9	....	...	....	-21	29
	110.0	54.4	....	...	....	-21	29
n	79.4	0.81	24.6	1.5x10^{10}	23.6	-15.7	29.1
2 M	99.4	4.98	....	1.4	....	-15.9	29.5
	110.0	13.9	....	1.5	....	-16.1	29.8

a) Compound designated by iso is 1-hydroxy-iso-butyl iso-butyl peroxide, n is 1-hydroxy-n-butyl n-butyl peroxide. Concentrations are given as molal or moles per 1000 g. solution. b) Arrhenius energy of activation based on results from three temperatures. c) Arrhenius frequency factor. d) Enthalpy of activation based on results from three temperatures. e) Entropy of activation. f) Free energy of activation calculated from $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$. g) These figures contain a large uncertainty because the points in the determination of $\Delta H^{\ddagger}$ and ΔE_a at 5 Molal did not fall on a straight line. The maximum deviations are as follows: ΔE_a, ± 3.2 kcal./mole; A, from 3x10^7 to 6x10^{10} sec.$^{-1}$; $\Delta H^{\ddagger}$, ± 3.1 kcal./mole; $\Delta S^{\ddagger}$, ± 8 cal./mole degree; $\Delta F^{\ddagger}$, ± 6 kcal./mole. The results in the other two cases were exactly fitted by a straight line thus no range was obtained for them.

are found in the decomposition products and that the reaction between aldehydes and hydroperoxides goes spontaneously to give the 1-hydroxyalkyl alkyl peroxide. Upon decomposing, the latter compound yields aldehyde which can then react with more hydroperoxide, thus small amounts of aldehyde serve as catalysts for the decomposition of primary alkyl hydroperoxides.

Microfilm $2.00; Xerox $4.40. 84 pages.

A STUDY OF SOME REACTIONS OF BENZOYL PEROXIDE AND T-BUTYL PERBENZOATE.

(L. C. Card No. Mic 59-3574)

Gerald Feig, Ph.D.
Rutgers University, 1959

Major Professor: Donald B. Denney

Part I -- A Study of the Reactions of Benzoyl Peroxide and t- Butyl Perbenzoate with N,N'-Dicyclohexylcarbodiimide.

N,N'-Dicyclohexylcarbodiimide reacts with benzoyl peroxide in isopropyl alcohol to give N-benzoyl-N,N'-dicyclohexylurea, acetone, benzene and carbon dioxide. The same reactants in carbon tetrachloride give N-cyclohexylbenzamide, chlorobenzene, cyclohexyl isocyanate and carbon dioxide.

t-Butyl perbenzoate and N,N'-dicyclohexylcarbodiimide react in n-butyl alcohol to give N-cyclohexylbenzamide, n-butyraldehyde and n-butyl N-cyclohexylcarbamate.

Free radical mechanisms are proposed.

Part II -- An Oxygen-18 Tracer Study of the Decomposition of Benzoyl Peroxide in Diethyl Ether.

The reaction of benzoyl peroxide with diethyl ether is known to involve an induced decomposition superimposed upon a unimolecular decomposition process. The major products of this reaction are 1-ethoxyethyl benzoate and benzoic acid.

Benzoyl peroxide, labeled with oxygen-18 in both carbonyl oxygens, was allowed to react with diethyl ether at reflux temperature for a period of 7 days. The results of this investigation have shown that the mechanism of the decomposition involves predominate, if not exclusive, attack of an α-ethoxyethyl radical at the ether oxygen atoms of benzoyl peroxide. The benzyl alcohol obtained from the lithium aluminum hydride reduction of 1-ethoxyethyl benzoate contained 82% of the excess oxygen-18 originally incorporated in the carbonyl oxygen atom of the benzoyl peroxide. This value was obtained only when the decomposition was performed in the presence of sodium hydride, which removed the benzoic acid as it was formed by converting it to insoluble sodium benzoate. This was necessary as it was found that the benzoic acid formed during the reaction exchanged with 1-ethoxyethyl benzoate.

If the α-ethoxyethyl radical had attacked exclusively at the ether oxygen atoms of the benzoyl peroxide, the benzyl alcohol would have contained 100% of the excess oxygen-18. Attack at the carbonyl oxygen of benzoyl peroxide would eventually lead to benzyl alcohol containing none of the excess oxygen-18. The observed lower value (less than 100%) may be explained by attack at both positions or by a partial equilibration of the carboxyl oxygen atoms of the 1-ethoxyethyl benzoate during the reaction.

Possible causes for the partial equilibration found are (1) ionization of 1-ethoxyethyl benzoate, (2) exchange of this ester with benzoic acid or sodium benzoate, (3) equilibration during the lithium aluminum hydride reduction step and (4) exchange of labeled benzoyl peroxide with some component of the reaction mixture. At the present time it is not possible to decide which of the paths causes the equilibration.

The oxygen-18 results of this study have served to eliminate some postulated mechanisms for the decomposition of benzoyl peroxide in diethyl ether.

Part III -- An Oxygen-18 Tracer Study of the Cupric Chloride Catalyzed Reaction of t-Butyl Perbenzoate with Cyclohexene.

The copper salt catalyzed reaction of t-butyl perbenzoate with olefins is known to proceed without double bond isomerization to give only one allylic benzoate. A comparable reaction with benzoyl peroxide gives mixtures of allylic benzoates in addition to other products.

This investigation was carried out to gain information about the mechanism of the cupric chloride catalyzed reaction of t-butyl perbenzoate with cyclohexene.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Cyclohexene and t-butyl perbenzoate-carbonyl-O^{18} were allowed to react in the presence of 1 mole % cupric chloride. The Δ^2-cyclohexenyl benzoate obtained was hydrogenated to give cyclohexyl benzoate. Lithium aluminum hydride reduction of this ester produced benzyl alcohol and cyclohexanol containing 51% and 49%, respectively, of the excess oxygen-18 originally incorporated in the t-butyl perbenzoate. These results have shown that the carboxyl oxygen atoms of the perester became equivalent during the catalyzed reaction.

A mechanism is proposed.

Microfilm $2.00; Xerox $3.80. 69 pages.

STUDIES IN MEDICINAL CHEMISTRY. STEREOCHEMISTRY OF POTENTIAL PHARMACODYNAMIC DERIVATIVES OF OXAGRANATANINE.

(L. C. Card No. Mic 59-4221)

Fred R. Gerns, Ph.D.
University of Virginia, 1959

The subject of this dissertation is a study of the stereochemistry of the 3-oxa- and 3-thiagranatanine ring systems. A number of derivatives of 3-oxagranatanine were prepared for biological evaluation.

The Historical Section of the dissertation presents the nomenclature of these ring systems, a review of the alkaloids of the tropane and granatanine groups, and a brief discussion of the biologically active synthetic scopolamine derivatives. Previously reported methods of synthesizing the 3-oxagranatanine ring system are presented.

The steric course and mechanisms of the reduction of cyclic ketones and ketoximes are discussed in the Theoretical Section, as well as the use of nitrogen-oxygen acyl migrations and tetrahydrooxazine formation in determining the stereochemistry of amino alcohols. The stereochemistry of the tropanols, their homologs and analogs is presented.

Dimethylbenzyloxyacetal was debenzylated by sodium in liquid ammonia and the sodium salt of the dimethylhydroxyacetal coupled with dimethylchloroacetal to give β,β'-dimethoxyethyl ether. The oxy-bisacetaldehyde was liberated in situ and used in condensation with methylamine hydrochloride and acetonedicarboxylic acid to form 9-methyl-3-oxagranatanin-7-one. This ketone yields the axial, anti-epimer, 9-methyl-3-oxagranatanin-7α-ol, m.p. 144-146°, on hydrogenation with a Raney nickel or ruthenium catalyst in acetic acid solution, as well as by reduction with lithium aluminum hydride in ether and with lithium tri-t-butoxyaluminum hydride in Diglyme. On the other hand, reduction with sodium and n-amyl alcohol yields the equatorial, syn-epimer, 9-methyl-3-oxagranatanin-7β-ol, m.p. 111.5-113.5°. The infrared spectra of the epimers show notable differences in the 9-12 μ region. The syn-conformation of 9-methyl-3-oxagranatanin-7β-ol was shown by acyl migrations and tetrahydrooxazine formation. 7β-Benzoyloxy-3-oxagranatanine rearranged to 9-benzoyl-3-oxagranatanin-7β-ol in aqueous base in one hour, whereas the epimeric ester hydrolyzed under the same conditions. 9-Benzoyl-3-oxagranatanin-7β-ol rearranged to the norester in a solution of dioxane saturated with hydrogen chloride within 20 hours at room temperature. Under the same conditions the epimeric amide was recovered unchanged. 3-Oxagranatanin-7β-ol formed a tetrahydrooxazine derivative with p-nitrobenzaldehyde whereas the epimer formed only intractable material.

9-Methyl-3-thiagranatanin-7-one was prepared by condensation of thio-bisacetaldehyde, liberated in situ from its tetramethylacetal, methylamine hydrochloride and acetonedicarboxylic acid. Reduction with sodium and n-amyl alcohol gave, after chromatography, the syn-carbinol, melting at 116.5-118.5°. It was demethylated and oxidized to the nor-sulfone which was then condensed with p-nitrobenzaldehyde to give the not quite pure tetrahydrooxazine derivative.

7β-Benzhydryloxy-9-phenethyl-3-oxagranatanine was prepared in three steps from 3-oxagranatanin-7β-ol. 7β-Benzilyloxy-9-methyl-3-oxagranatanine was prepared by a transesterification reaction of 9-methyl-3-oxagranatanin-7β-ol with methyl benzilate. An attempt to prepare the benzhydryl ether of 9-methyl-3-oxagranatanin-7α-ol by reaction with diphenyldiazomethane failed. 7β-Amino-9-methyl-3-oxagranatanine was prepared by sodium and n-amyl alcohol reduction of the corresponding ketoxime. Lithium aluminum hydride and sodium amalgam reduction of the ketoxime failed. 9-Methyl-3-oxagranatanin-7-one was carbomethoxylated in the 6-position with dimethyl carbonate and sodium in xylene. Attempts to reduce the keto-group by various means failed. Reaction of phenyl lithium with 9-methyl-3-oxagranatanin-7-one gave the phenyl carbinol.

Microfilm $2.00; Xerox $6.40. 132 pages.

STUDIES OF THE LEUCKART THIOPHENOL REACTION.

(L. C. Card No. Mic 59-4111)

Casimir Louis Gladys, Ph.D.
Vanderbilt University, 1959

Supervisors: Professors Lamar Field and Donald E. Pearson

The Leuckart reaction of an arenediazonium salt with potassium ethylxanthate normally gives a red oily product which generally is considered to consist mainly of the aryl ethylxanthate. In at least four instances, however, a bis-aryl dithiolcarbonate had been observed as a constituent of the red oil. J. R. Cox of this laboratory found a fifth instance. In the present continuation of the work of Cox, the red oil formed from the Leuckart reaction of 2,6-dimethylbenzenediazonium hydrogen sulfate and potassium ethylxanthate was separated into its major components by chromatography on alumina. The major constituents and yields, based on 2,6-dimethylaniline, were ethyl ethylxanthate (44%), 2,6-dimethylphenyl ethylxanthate (23%), and bis-(2,6-dimethylphenyl) dithiolcarbonate (62%). Also present, but in much smaller amounts, were 2,6-dimethylphenol and nitrogen-containing substances presumed to be coupling products of the diazonium salt with an amine or phenol, based on apparent reduction with sodium hydrosulfite.

The Leuckart reaction then was applied to other substituted arenediazonium salts in an effort to determine

electrical and steric effects on the formation of the dithiolcarbonate which was obtained in every instance. The formation of the dithiolcarbonates appears to be dependent, at least to some extent, on the steric-electrical influences of the various substituents, as can be observed from the yields of the various dithiolcarbonates obtained: diphenyl dithiolcarbonate, 11%; bis-(o-tolyl) dithiolcarbonate, 45%; bis-(2, 6-dimethylphenyl) dithiolcarbonate, 62%; bis-(2,6-diethylphenyl) dithiolcarbonate, 40%; bis-(p-methoxyphenyl) dithiolcarbonate, 12%; and bis-(p-nitrophenyl) dithiolcarbonate, 24%. The amount of the corresponding aryl ethylxanthates formed (ranging from 23 to 41%) appears to be influenced only to a small extent, if at all, by the same steric-electrical effects which govern the formation of the dithiolcarbonate.

Ethyl ethylxanthate, an unexpected product of the reaction, was found to be present in the reaction mixture in all instances, with one possible exception; reaction of p-nitrobenzenediazonium hydrogen sulfate by the Leuckart procedure apparently resulted in no ethyl ethylxanthate in the red oily product obtained. The amount of ethyl ethylxanthate obtained indicated a dependence on the formation of the dithiolcarbonate as given by the following equation,

$$2\ KS\text{-}\overset{S}{\overset{\|}{C}}\text{-}OEt + 2\ ArN_2X \rightarrow ArS\text{-}\overset{O}{\overset{\|}{C}}\text{-}SAr + EtS\text{-}\overset{S}{\overset{\|}{C}}\text{-}OEt + 2N_2 + 2KX$$

i.e., for each mole of dithiolcarbonate formed, a mole of ethyl ethylxanthate also was formed.

Substitution of isopropyl and benzyl groups for the O-ethyl portion of potassium ethylxanthate appeared to have little or no effect on the formation of the dithiolcarbonate, when these xanthate salts were employed in place of potassium ethylxanthate in the Leuckart reaction.

During the course of addition of the p-nitrobenzenediazonium hydrogen sulfate to potassium ethylxanthate, a red solid complex formed which appeared to be stable under the conditions normally sufficient to cause instantaneous decomposition of the diazonium salt or complex to the red oily intermediate usually obtained in the Leuckart reaction.

Possible mechanisms for the formation of bis-aryl dithiolcarbonates, aryl xanthate esters and ethyl ethylxanthate, are considered in the light of the evidence obtained by this study. Microfilm $2.00; Xerox $5.20. 101 pages.

A STUDY OF ULTRAVIOLET ABSORPTION SPECTRA OF SUBSTITUTED CHALCONES.

(L. C. Card No. Mic 59-4225)

Bernard Joseph Haske, Ph.D.
University of Virginia, 1959

Part I of this dissertation deals with substituted α-phenacyldibenzoylmethanes and their enols. Preliminarily the ions of copper, cobalt, nickel and zinc were studied as possible complexing ions for cis-phenacyldibenzoylmethane enol. Only copper was found to be effective. Unsuccessful attempts to synthesize certain substituted α-phenacyldibenzoylmethanes for a study of enol sterioisomerism resulted in anomolous products.

In the attempt to make 2-(p-bromophenyl)-3-benzoyl-5-phenylfuran by a Friedel-Crafts reaction between benzoyl chloride and 2-(p-bromophenyl)-5-phenylfuran resulted mainly in p-bromodibenzoylethane together with a little 2-(p-bromophenyl)-5-(p-benzoylphenyl)-furan. The failure of substitution to occur at the furan nucleus is attributed to deactivation of the furan ring by the p-bromophenyl group. A mechanism of ring cleavage by aluminum chloride is offered.

The attempt to prepare p-methoxydibenzoylethylene by Friedel-Crafts reaction between anisole and β-benzoylacrylyl chloride gave α,γ-dianisyl-γ-phenylbutyrolactone which was identified by absorption spectra and by partial oxidative cleavage to anisic acid and α-anisylstyrene. The latter was presumed to have resulted from an incomplete oxidation to a ditertiary diol followed by cleavage and dehydration to the α-anisylstyrene, for which there exists mechanistic analogy. The butrolactone was assumed to have arisen through conjugate addition of anisole to β-benzoylacrylyl chloride, cyclization and substitution at the γ-position.

In Part II, an attempt is made to correlate the ultraviolet absorption spectra of various β-phenylchalcone systems, which are cross conjugated, with those of parent chalcones. Assignments of absorption bands to structural features were difficult because of serious overlap of the various bands involved, but were facilitated by the bathochromic effect of a suitable substituent on one or the other of the absorbing systems.

Earlier assignments of long wave-length absorption to the through-conjugated chalcone system, of the middle wave-length absorption to the aroyl group, and of the short wave-length absorption to secondary absorption of the longest conjugated system, were verified and to some extent modified. The β-phenyl group offers cross conjugation and a α-arylstyrene chromophore which seemed to contribute to the short and middle wave-length absorptions.

Among the β-phenylchalcones prepared, β-phenyl-p-methoxychalcone and β-phenyl-p,p'-dimethoxychalcone had the added possibility of cis-trans isomerism. Only one isomer was isolated in each case but irradiation caused photoequilibration. On the basis of ultraviolet spectra, the isolated compounds were assigned the configuration cis with respect to the anisyl group. In the formation of the cis configuration by dehydration of the β-hydroxydiarylpropiophenone, it was postulated that a chelation effect in the transition state was favored by the methoxy group and was responsible for the steric mode of dehydration. β-Phenyl-p-bromo-p'-methoxychalcone, on the other hand, was prepared in both cis and trans forms, which were very similar in ultraviolet absorption.

Independent synthesis and spectral study of α-anisyl styrene supported the previous postulation that absorption by this system contributed to produce both short and middle wave-length bands. This compound was also studied with regard to the cross-conjugation of the styrene and p-methoxystyrene systems and their approach to planarity. Steric limitations prevent complete planarity and there must be some overlap of phenyl groups. The strong absorption of both chromophores in the ultraviolet absorption seemed to indicate the presence of two conformational extremes whereby most of the molecules more closely approach one or the other of the two possible planar forms. Each of these forms may be absorbing differently and semi-independently.

Part III, which concerns the effect of electronic substituents on the ratio of 1,2 to 1,4-addition of phenylmagnesium bromide and phenyllithium to two p,p'-disubstituted

trans-chalcones, stemmed from attempts to synthesize substituted β-phenylchalcones of interest in ultraviolet absorption studies (Part II). There was a consistent and significant decrease in the ratio of 1,2 to 1,4-additions of phenyllithium, which was attributed to the strong electron donative effect of the methoxy group in stiffening the conjugated system.

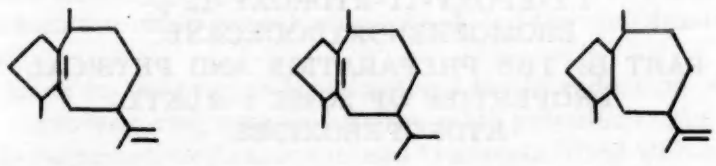
Microfilm $2.10; Xerox $7.40. 158 pages.

A STUDY OF THE SELENIUM DEHYDROGENATION OF GUAIOL AND RELATED COMPOUNDS.

(L. C. Card No. Mic 59-3422)

William T. House, Ph.D.
University of Cincinnati, 1959

A study was made of the selenium dehydrogenation of guaiene (A), i-dihydroguaiene (B), e-dihydroguaiene (C), tetrahydroguaiene (D) and guaiol (E). In preliminary experiments with compounds (A), (B), and (E) it was found that results were not reproducible under the classical



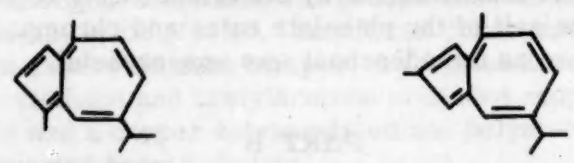
A B C



D E

conditions of just heating the compound and the selenium together at high temperatures, but qualitative evidence was obtained that some organoselenium intermediate was involved in the formation of hydrogen selenide. The infrared absorption spectrum of non-aromatic material recovered from a dehydrogenation of guaiene indicated that it had been hydrogenated. After the preliminary experiments failed to give reproducible results, it was found that results were reproducible when the reactions were carried out in m-terphenyl as solvent. Most of the experiments were carried out in this solvent in the temperature range from 270°C to 290°C.

According to the literature (19,56,58) all the above compounds lead to S-guaiazulene on dehydrogenation with sulfur and to Se-guaiazulene on dehydrogenation with selenium. However, Birrell (70) obtained S-guaiazulene by dehydrogenation with selenium. In this work dehydrogenation with selenium for relatively short reaction times led



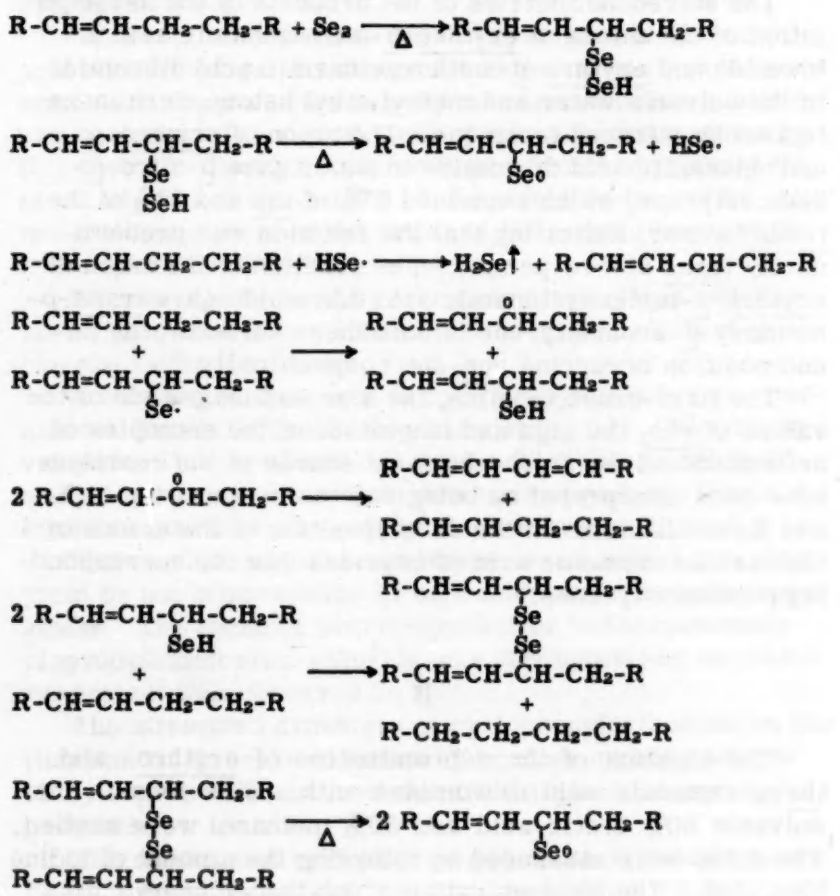
S-Guaiazulene Se-Guaiazulene

to mixtures of the two compounds. The evidence indicated that S-guaiazulene was formed first and then isomerized. Qualitative evidence was obtained that S-guaiazulene would isomerize to Se-guaiazulene at 290°C independent of the dehydrogenation reaction but in the presence of selenium. The isomerization did not occur in the absence of selenium.

The relative yields of guaiazulene from dehydrogenation of compounds (A), (B), (C), and (D) were determined for one hour reaction time and were found to be as follows: The yields from compounds (B) and (C) were approximately equal, while the yield from compound (A) was about three times the yields from (B) and (C). The yield from (D) was about one-tenth the yields of (B) and (C).

Guaiene was studied in greater detail and the following observations were made: (1) increasing the amount of solvent did not appreciably alter the amount of guaiazulene formed in a given time, (2) adding benzoyl peroxide (5% by weight of starting guaiene) increased the amount of guaiazulene formed in five hours by about 20%, (3) doubling the starting weight of guaiene, while holding the selenium constant, approximately doubled the amount of guaiazulene formed in a given time, (4) the selenium could be reduced to a very small amount without appreciably affecting the amount of guaiazulene formed in a given time and far more guaiazulene was formed than could be accounted for by the selenium reacted and the hydrogen selenide evolved, and (5) lowering the temperature from 290°C to 270°C did not appreciably affect the amount of guaiazulene formed but gave a much lower ratio of Se-guaiazulene to S-guaiazulene.

The reaction appears to proceed principally by a hydrogen transfer whereby part of the starting material is aromatized and part of the material is hydrogenated. This would explain the relative yields obtained for compounds (A), (B), (C), and (D), as well as the other observations. It was further found that the yield of guaiazulene from guaiene could be greatly increased by carrying the reaction out in



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oleic acid which, with its isolated double bond, could act as a hydrogen acceptor. The preceding series of reactions was suggested as a possible mechanism for the hydrogen transfer. The radicals formed in the last reaction could abstract hydrogen again and there would be a cycle between the dialkyl diselenides and the selenols which would transfer hydrogen from one place to another.

Microfilm $2.00; Xerox $4.60. 90 pages.

ELIMINATION REACTIONS OF CINNAMIC ACID DIBROMIDE AND ITS DERIVATIVES. PART I: DECARBOXYLATIVE ELIMINATION. PART II: DEBROMINATION.

(L. C. Card No. Mic 59-4345)

Khairat Mohammed Ibne-Rasa, Ph.D.
Brown University, 1959

I

The rates of the decomposition of the anions of cinnamic acid dibromide and its p-nitro and p-methoxy analogs leading to olefins, were measured in the solvents water, absolute ethanol and methyl ethyl ketone. The runs were followed by measuring the amount of iodine liberated by the unreacted acid dibromide when treated with potassium iodide. The reactions gave good first order kinetics. The rates were measured at two different temperatures and activation parameters were calculated from the first-order specific rate constants thus obtained. The entropies of activation were correlated with the mechanism of the decomposition. The values of the reaction constant rho of the Hammett equation were calculated for the solvents water, absolute ethanol and methyl ethyl ketone.

The stereochemistries of the products of the decomposition of the anions of erythro-p-nitrocinnamic acid dibromide and erythro-p-methoxycinnamic acid dibromide in the solvents water and methyl ethyl ketone were investigated by infrared technique. The anion of erythro-p-nitrocinnamic acid dibromide in water gave p-nitro-β-bromostyrene, which contained 67% of cis and 33% of the trans isomer, indicating that the reaction was predominantly trans stereospecific. The reaction of the anion of erythro-p-methoxycinnamic acid dibromide gave trans-p-methoxy-β-bromostyrene in both these solvents, the decomposition occurring non-stereospecifically.

The first-order kinetics, the sign and magnitude of the values of rho, the sign and magnitude of the entropies of activation and the stereochemical course of the reactions have been interpreted as being due to the operation of E_1 and E_2 mechanisms in the decomposition of the anions of the various cinnamic acid dibromides into the corresponding β-bromostyrenes.

II

The kinetics of the debromination of erythro- and threo-cinnamic acid dibromides with iodide ions in the solvents 80% acetic acid and 80% methanol were studied. The rates were measured by following the amount of iodine liberated. The debromination of erythro-cinnamic acid dibromide was found to obey the second-order kinetic law, being first order in the concentrations of each reactant. Activation parameters were calculated from the second-order rate constants determined at two different temperatures in each solvent system. The effect of added bromide and perchlorate ions on the rate of debromination was investigated. The presence of a slight positive salt effect and the absence of any mass law effect was established.

The reaction of erythro-cinnamic acid dibromide with potassium iodide in 80% acetic acid gave trans-cinnamic acid in 88% yield under conditions which did not cause cis-cinnamic acid to isomerize to the trans compound.

It has been suggested in this thesis that the facts mentioned above are best explained on the assumption that the debromination of erythro-cinnamic acid dibromide with iodide ions occurs according to an E_2 type mechanism.

An estimate of the "cis effect" due to phenyl-carboxyl eclipsing in the E_2 transition state of threo-cinnamic acid dibromide has been obtained by comparing the rates of the debrominations of the two diastereoisomeric cinnamic acid dibromides. Microfilm $2.00; Xerox $6.40. 133 pages.

PART A: THE ATTEMPTED RESOLUTION OF 1,2-EPOXY-11-HYDROXY-12-p-BROMOPHENOXYDODECANE. PART B: THE PREPARATION AND PHYSICAL PROPERTIES OF SOME n-ALKYL HYDROPEROXIDES.

(L. C. Card No. Mic 59-3805)

Paul Dale Klimstra, Ph.D.
State University of Iowa, 1959

Chairman: Professor S. Wawzonek

PART A

1,5-Hexadiene, 1,11-dodecadiene, and 1,17-octadecadiene were prepared from a Grignard reaction of 1,6-dichlorohexane and allyl chloride. The latter two dienes were purified by a silver nitrate complex.

The epoxidation of 1,5-hexadiene, 1,11-dodecadiene, and 1,17-octadecadiene was studied and found to occur in a stepwise manner confirming an earlier investigation. From these reaction studies 1,2,5,6-diepoxyhexane, 1,2,11,12-diepoxydodecane, and 1,2,17,18-diepoxyoctadecane were isolated. Acid hydrolysis of 1,2,17,18-diepoxyoctadecane gave 1,2,17,18-tetrahydroxyoctadecane.

The bromination of these same three dienes was found to be erratic. From these reactions 1,2,5,6-tetrabromohexane, 1,2,11,12-tetrabromododecane, and 1,2,17,18-tetrabromooctadecane were isolated.

1,2-epoxy-11hydroxy-12-p-bromophenoxydodecane was prepared by treating 1,2,11,12-diepoxydodecane with sodium-p-bromophenoxide and was fractionally crystallized into two racemic modifications. The resolution of one of the racemic modifications by the brucine or l-α-phenylethylamine salt of the phthalate ester and chromatography with lactose as the adsorbant was unsuccessful.

PART B

The methanesulfonate of dodecanol-1, tetradecanol-1, hexadecanol-1, and octadecanol-1 were prepared by

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treating the alcohol with methanesulfonyl chloride in the presence of pyridine.

The alkylation of hydrogen peroxide with n-dodecyl, tetradecyl, hexadecyl, and octadecyl methanesulfonate gave the corresponding hydroperoxides. The infrared analysis of each indicated that the chief impurity present was the corresponding aldehyde. The by products isolated from the reaction mixtures were n-dodecyl, tetradecyl, and hexadecyl peroxide. Microfilm $2.00; Xerox $5.00. 98 pages.

POLYMERS CONTAINING COORDINATED METAL CATIONS.

(L. C. Card No. Mic 59-3879)

Fred W. Knobloch, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: William H. Rauscher

The preparation of a number of organic polymers containing coordinated metal cations was investigated. Two types of polymers were studied; those prepared from monomers already possessing the coordinated cation and those in which the chain growth step introduced the coordination bond.

Work on the former type involved the introduction of the ferrocene ring system into the main polymer chain. 1, 1'-Dicarbomethoxyferrocene was transesterified with ethylene glycol to produce the corresponding polyester. 1,1'-Ferrocenedicarbonyl chloride was synthesized and condensed at liquid-liquid interfaces with ethylenediamine, hexamethylenediamine, piperazine and p-phenylenediamine to form polyamides and with 4,4'-isopropylidenediphenol and hydroquinone to form polyesters. Intrinsic viscosities of the soluble polymers ranged from 0.10 to 0.25. Fibrous strands were drawn from solutions of the soluble polymers and the polyamide prepared from piperazine was shown to crystallize readily.

Polymers in which the chain growth step resulted in formation of the coordination bond were prepared from bis-(1,3-carbonyl-enol) systems and simple compounds containing the metal cation. A melt polymerization involving beryllium acetylacetonate and 1,4-dihydroxyanthraquinone produced a polymer with a degree of polymerization of 5.1.

An interfacial technique, comparable to that employed for polycondensations with diacid chlorides, was developed for the preparation of coordination polymers from bis-(1, 3-carbonyl-enol) systems. Polymers were prepared by mixing an aqueous solution of the tetraamminecopper(II) complex with non-aqueous solutions of either tetraacetylethane or 1,4-dihydroxyanthraquinone. Attempts to prepare a new monomer, hexane-2,3,4,5-tetrone, were unsuccessful. Molecular weight determinations by end group analysis were not possible due to the failure of attempts to introduce nitrogen-containing end groups such as ammonia, ethylenediamine or glycine. Interfacial condensation between the cupric ammine complex ion and mixtures of tetraacetylethane and acetylacetone produced copper acetylacetonate and a copper-tetraacetylethane polymer instead of the expected hybrid chelate.

Model experiments indicated that block polymers could not be prepared by interfacial condensations between an acid chloride and a hydroxyl function which was part of a 1,3-carbonyl-enol system.

Evidence was obtained for the formation of polyterephthaloyl anhydride from a condensation of the pyridine complex of terephthaloyl chloride with water.

Microfilm $2.00; Xerox $6.80. 142 pages.

THE PREPARATION OF ALKYLHYDRAZINES.

(L. C. Card No. Mic 59-3880)

James L. Kreuzer, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: John B. Cloke

The purpose of this research was to investigate synthetic routes for the production of alkylhydrazines which in turn might be used for the synthesis of pharmaceutically useful compounds. Amines were chosen as the starting materials for the syntheses because of the ready availability of many alkylamines.

A new method of preparing substituted hydrazines was developed, viz., by the reduction of alkylnitrosoureas to alkylsemicarbazides by means of titanium trichloride. In order to investigate this reaction, the series of alkylnitrosoureas from methyl- to n-butyl- was prepared by reaction of the amine with nitrourea and nitrosation of the resulting alkylurea. This series of alkylnitrosoureas was reduced in good yield to the corresponding alkylsemicarbazides, which yield monoalkylhydrazines by hydrolysis. Methylnitrosourethane was also reduced by this method in good yield to 2-methyl-2-carbethoxyhydrazine which was isolated as 1-(m-nitrobenzylidene)-2-methyl-2-carbethoxyhydrazine.

The reaction of amines with hydroxylamine-O-sulfonic acid was investigated. It was found that a large excess of amine and the presence of gelatin in the reaction mixture are necessary for a good yield of monoalkylhydrazines by this method. Special equipment was designed to avoid the necessity of a large excess of unreacted amine, while still maintaining a yield of the order of 50% on the basis of the hydroxylamine-O-sulfonic acid.

Several other synthetic routes to alkylhydrazines were investigated but none of these proved to be as useful as the two preceeding methods.

A convenient synthesis of cyclopropylamine from commercial butyrolactone in overall yields of 35-40% was developed. This synthesis afforded a 33-37% overall yield of cyclopropanecarboxylic acid as a by product. Some of the reactions of cyclopropylamine were investigated.

N-Benzylidenecyclopropylamine was prepared in good yield by tne condensation of benzaldehyde with cyclopropylamine. The thermal rearrangement of N-benzylidenecyclopropylammonium chloride was attempted and no rearrangement was observed.

The attempted synthesis of cyclopropylhydrazine by the titanium trichloride reduction of cyclopropylnitrosourea or cyclopropylnitrosourethane did not give the expected products.

The reaction of cyclopropylamine with hydroxylamine-O-sulfonic acid gave unsubstituted hydrazine. It was

believed that the production of hydrazine was a result of the degradation of cyclopropylamine either by oxidative attack by hydroxylamine-O-sulfonic acid or by a base-catalysed degradation. The base-catalysed degradation was eliminated by the observed stability of cyclopropylamine in strongly basic solution.

Microfilm $2.05; Xerox $7.40. 156 pages.

THE REACTIONS OF INDOLES WITH DIENOPHILES.

(L. C. Card No. Mic 59-3780)

Ronald Frederick Lange, Ph.D.
University of Minnesota, 1958

Adviser: Wayland E. Noland

Uncatalyzed reactions of dienophiles with indole and methyl-substituted indoles having open 3-positions involve Michael-type additions at the 3-position of the indole nuclei in all cases, except in the reactions of indole itself with dienophilic carboxylic acids of acid strength comparable to oxalic acid. In the latter cases, the reactivity of the acid as an α,β-unsaturated system is overshadowed by its ability to behave as an acid catalyst in the polymerization of indole. For example, phenylpropiolic acid and oxalic acid catalyze the polymerization of indole to triindole.

In continuation of the studies of the generality of addition of indole to nitroölefins (W. E. Noland and coworkers, J. Am. Chem. Soc., 76, 3227 (1954); 77, 456 (1955)), 2-methylindole and nitroethylene, β-nitrostyrene, β-methyl-β-nitrostyrene, and β-ethyl-β-nitrostyrene; 1,2-dimethylindole and nitroethylene, β-nitrostyrene, and β-methyl-β-nitrostyrene; and 1-methylindole and β-nitrostyrene were found to give the corresponding 1-to-1-adducts (I). The adduct from 2-methylindole and nitroethylene was hydrogenated and converted to the known picrate of 2-methyltryptamine, indicating that I may serve as a precursor of the corresponding tryptamines.

Maleic anhydride is somewhat unique in its reactions with methyl-substituted indoles with open 3-positions, since its acylating power predominates over its reactivity as an α,β-unsaturated system. 2-Methylindole and 1,2-dimethylindole with maleic anhydride give corresponding 1-to-1-adducts ((3-indole)-succinic anhydrides) (II) and 2-to-1-adducts (probably 2,3-bis-(3-indole)-4-keto-n-butyric acids) (III), the latter always being formed in the greater yield. Since II does not react with 2-methylindole or 1,2-dimethylindole under the conditions for formation of III, II cannot be an intermediate. Evidence that the corresponding 3-maleylindoles (4-(3-indole)-4-keto-2-butenoic acids) are possible intermediates in the formation of the 2-to-1-adducts (III) has been gained from the ready formation of a 1-to-1-adduct with 2-methylindole and a model compound, β-benzoylacrylic acid. 1-Methylindole and maleic anhydride also give a 2-to-1-adduct (III), but no 1-to-1-adduct was isolated. In each case, II was converted to the corresponding diacid (IV) and dimethyl ester (V), and III was converted to its monomethyl ester.

2-Methylindole and 1,2-dimethylindole with maleic acid also give the diacids (IV). In each case, IV was converted to the anhydride (II). The diacid (IV), from 1,2-dimethylindole and maleic acid, was converted to the dimethyl ester (V). The dimethyl ester (V) from esterification of the 1-to-1-adduct (II) of 2-methylindole and maleic anhydride was converted to IV. 1-Methylindole and maleic acid gave two unidentified products.

Stereoisomeric 1-to-1-adducts (VI), which have been hydrogenated to V, have been obtained from 2-methylindole and dimethyl acetylenedicarboxylate, one (believed to be dimethyl (2-methyl-3-indole)-fumarate) being formed in much larger amount than the other. Two unidentified products have been obtained from 2-methylindole and acetylenedicarboxylic acid. Reactions of indole and dimethyl acetylenedicarboxylate have yielded stereoisomeric 1-to-1-adducts (VI), two isomeric 2-to-1-adducts, one 4-to-2-adduct, one dehydro-1-to-2-adduct, two 1-to-3-adducts, and two unidentified trace products. The dehydro-1-to-2-adduct appears to be 1,2,3,4-tetramethoxycarbonyl carbazole, while the two isomeric 2-to-1-adducts appear to be dimethyl 2,3-bis-(3-indole)-succinates.

Indole and methyl vinyl ketone and 2-methylindole and benzalacetone give corresponding 1-to-1-adducts. Oximation of the indole-methyl vinyl ketone adduct gave a mixture of syn and anti forms, which were separated. 2-Methylindole and acrolein give a tris-indole (1,1,3-tris-(2-methyl-3-indole)-propane), indicating that the initial reactivity of the α,β-unsaturated system of acrolein predominates over the usual reactivity toward bis-indole formation of the aldehyde carbonyl group.

Microfilm $2.15; Xerox $7.60. 161 pages.

THE DISSOCIATION CONSTANTS OF SOME 2- AND 4-SUBSTITUTED-5-NITROANILINES.

(L. C. Card No. Mic 59-3906)

Aetius R. Lawrence, Ph.D.
Howard University, 1959

Chairman: Lloyd N. Ferguson

The difference in the tastes of 2- and 4-substituted-5-nitroanilines has prompted various attempts to correlate the tastes of these substances with their physical properties.[1] It is recognized that such a relationship is probably quite complex, thus there is need for reliable physical data concerning these compounds. This study was undertaken to provide such data. In particular, it sought to determine the dissociation constants of some of these compounds.

The dissociation constants of some 2- and 4-substituted-5-nitroanilines have been determined at 25°C. by a spectrophotometric method. The 2- and 4-substituents were CH_3O-, CH_3-, F-, Cl-, and Br-. In addition to these, the dissociation constants of p-toluidine and p-anisidine were determined by the same method. Calculation of the pK_a values were made from the equation[2]

$$pK_a = pH + \log (e_2 - e_3)/(e_1 - e_2) + \log f_{BH^+},$$

where e_1, e_3, and e_2 are the extinction coefficients at a given wave length in acidic solution, basic solution, and buffer solution of known pH, and f_{BH^+} is the activity coefficient of the protonated base.

Further, potentials at half neutralization were measured

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for these compounds by potentiometric titration in glacial acetic[3] acid using a glass electrode and a silver-silver chloride electrode as indicator and reference electrodes respectively. A reasonable linear relationship was found between the potentials at half neutralization and the dissociation constants determined in water.

The relative order of base strengths for these compounds was found to parallel the relative order of base strengths for the corresponding monosubstituted anilines and the nearly additive effect of a nitro group in the 5 position was pointed out. In each instance, the 2-isomer is a weaker base than the corresponding 4-isomer. It was concluded that those factors which determine the base strengths of the monosubstituted anilines also determine, to large measure, the base strengths of the 2- and 4-substituted-5-nitroanilines. No correlation between taste and base strengths was found.

The ultraviolet absorption spectra of the compounds were measured in acidic and basic solution and the marked resemblance of the spectra in acidic solution to the spectra of the monosubstituted anilines in ethanol was noted. Finally, it was shown that there is an increasing order of extinction coefficients for the band near 260 mu in acidic solution. Microfilm $2.00; Xerox $4.40. 82 pages.

1. L. N. Ferguson, A. R. Lawrence, Nature, in press.
2. L. A. Flexser, L. P. Hammett, A. Dingwall, J. Am. Chem. Soc., 57, 2103 (1935).
3. N. F. Hall, J. Am. Chem. Soc., 52, 5115 (19309).

THE SYNTHESIS OF ALKYLATING AGENTS AS POTENTIAL ANTICANCER AGENTS.

(L. C. Card No. Mic 59-3934)

Ernest Franklin LeVon, Ph.D.
University of Michigan, 1959

An investigation has been made into the synthesis of some nitrogen mustards related to the 8-aminoalkylaminoquinolines. The latter have been extensively studied as antimalarials and the nitrogen mustards are known to be active anticancer agents. It was hoped that the combination would afford a drug which would concentrate the action of the mustard moiety and thus minimize their general toxic side effects. One such derivative has been reported previously, but of somewhat dubious purity. A synthetic method was desired which would afford a series of these of suitable purity.

The purification of 2-methoxy-8-(3-phthalimidopropylamino)-quinoline and its reaction with hydrazine were studied in the interest of preparing 8-[3-bis-(2-chloroethyl)-aminopropylamino]-2-methoxyquinoline. This resulted in the characterization of 8-(3-aminopropylamino)-2-methoxyquinoline as its dibenzenesulfonyl derivative, the isolation of 8-bis-(3-phthalimidopropyl)-amino-2-methoxyquinoline, and the isolation of phthalo-bis-[3-(2-methoxy-8-quinolylamino)-propyl]-amide. 8-(3-Hydroxypropylamino)-2-methoxyquinoline obtained from 8-amino-2-methoxyquinoline and trimethylene bromohydrin was not readily purified as the hydrobromide.

The reaction of trimethylene chlorobromide and diethanolamine was studied in various solvents, both with and without sodium carbonate. However the desired 3-chloropropyl-bis-(2-hydroxyethyl)amine was not isolated in any pure form. Substituting 3-chloropropyl tosylate for trimethylene chlorobromide did not help.

Conversion of 1-bis-(2-hydroxyethyl)-amino-4-pentanone to its ketal failed. However 3-chloropropionaldehyde acetal reacted with diethanolamine to give 3-(diethanolamino)-propionaldehyde acetal in good yield. Reductive alkylation of 8-amino-6-methoxyquinoline failed with the above acetal and also with butyraldehyde.

8-Butyramido-6-methoxyquinoline was prepared and the carbonyl group reduced to methylene with lithium aluminum hydride. Addition of diethanolamine to methyl acrylate gave crude methyl 3-bis-(2-hydroxyethyl)-aminopropionate which decomposed on distillation. Propiolactone and 8-amino-6-methoxyquinoline in refluxing benzene gave both N-(6-methoxy-8-quinolyl)-β-alanine and 6-methoxy-8-hydracrylamidoquinoline. This β-alanine was also obtained by hydrolysis of the adduct of 8-amino-6-methoxyquinoline and methyl acrylate. It gave 8-(3-hydroxypropylamino)-6-methoxyquinoline on reduction with lithium aluminum hydride. The hydracrylamide and thionyl chloride gave 6-methoxy-8-(3-chloropropionylamido)-quinoline which was more readily obtained from the nucleus and 3-chloropropionyl chloride.

Reaction of 6-methoxy-8-(3-chloropropionylamido)-quinoline and diethanolamine gave 8-[3-bis-(2-hydroxyethyl)-aminopropionylamido]-6-methoxyquinoline which was converted to 8-[3-bis-(2-chloroethyl)-aminopropionylamido]-6-methoxyquinoline with thionyl chloride. Preliminary screening of this mustard against an experimental rat tumor indicated considerable activity and relatively low toxicity. The intermediate diol was reduced with lithium aluminum hydride in tetrahydrofuran to 8-[3-bis-(2-hydroxyethyl)-aminopropylamino]-6-methoxyquinoline.

5,6-Dimethoxy-8-aminoquinoline, 6-methoxy-8-aminolepidine, and 2-methoxy-8-aminoquinoline were each converted to the 3-bis-(2-chloroethyl)-aminopropionyl derivatives via their 3-chloropropionyl derivatives and the mustard-diols as described for the 6-methoxy analog. In one run the mustard of the 2-methoxyquinoline was accompanied by a considerable amount of the isomeric 1-methyl-2-quinolone apparently resulting from a rearrangement of the 2-methoxy group.

Thus a practical synthetic route has been found for an interesting series of 8-bis-(2-chloroethyl)-aminopropionylamidoquinolines. Some of the intermediates have been converted to precursors of nitrogen mustards analogous to 8-aminoalkylaminoquinoline antimalarials.

Microfilm $2.00; Xerox $5.20. 104 pages.

STUDIES IN THE KINETICS OF FREE RADICAL CHAIN REACTIONS.

(L. C. Card No. Mic 59-4080)

Mahmood Fayad Mayahi, Ph.D.
Columbia University, 1959

The relative reactivities of primary, secondary and tertiary C-H bonds are found to be greatly altered by solvents like carbon disulfide, benzene and chlorobenzene, the $\frac{t}{p}$-ratio for 2,3-dimethylbutane is changed from 3.7 in

CCl_4 at 68° to 24 in 5.6M benzene, and to 34 in 11.1M CS_2 at 68°; and the $\frac{s}{p}$ ratio for n-butane is changed from 2.69 in bulk at 68° to 6.55 in 11.1M CS_2 at 68°. This solvent effect extends to competitive reactions between different molecules, to the relative reactivities of primary and secondary hydrogens, and even different types of primary hydrogens.

A notable feature of these solvent effects is the pronounced temperature dependence of chlorine atom selectivity in solvents where this selectivity is high. Differences in the activation energy for the chlorine atom attack on different types of hydrogen were determined. In bulk differences are small. However in carbon disulfide the differences amount to several Kcal/mole and are in fact larger than the actual activation energy for chlorine atom attack on primary hydrogen.

The relative reactivities of small ring compounds towards hydrogen abstraction by chlorine atom were found to decrease in the following order, in CCl_4 at 68°, cyclohexane, cyclopentane, cyclobutane, cyclopropane. The reactivity per hydrogen of cyclohexane is less than that of the secondary hydrogen of n-butane. The selectivity decreases at 0°, and this is paralleled by the apparent decrease in selectivity in 7.3M benzene. Chlorination of 2,3-dimethylbutane in 13.7M cyclopropane at 0°C gave a $\frac{t}{p}$ ratio of 34 ± 4 compared to 5 without cyclopropane. This suggests that chlorine atoms can complex with small rings.

Chlorination of molecules with polar substituents like ethyl chloride, n-butyl chloride, propionyl chloride etc. showed that solvent effects extend to deactivated C-H bonds. n-Butyl chloride is chlorinated in several solvents and over a range of temperatures. It is concluded that in these systems complexing increases rather than decreases the electron accepting properties of the chlorine atom. Competitive chlorination of polar molecules in CCl_4 and in 11.1M CS_2 at 68° and at 0°C supported this conclusion.

Chlorination of propionitrile and butyronitrile shows that the nitrile group enhances the reactivity of the α-C-H bonds.

By competitive chlorination the relative reactivities of C-H bonds in hydrocarbons with electron withdrawing groups are quantitatively related to those of n-butane and it is found that the inductive effects extend along a normal carbon chain at least to four carbons as in the case of n-butyl chloride.

An empirical method is described for the prediction of relative reactivities of two or more molecules, and for the prediction of relative reactivities of different C-H bonds within any one molecule. This empirical method was developed by competitively chlorinating ethyl chloride, n-propyl chloride, and n-butyl chloride, and also chlorination of propionic acid, n-butyric acid, and n-valeric acid, at 68° in CCl_4. The increase of $-CH_2-$ group is responsible for the increase in the relative reactivity. It was found that if these relative reactivities are plotted against the square of the distance of the last $-CH_2-$ group in the molecule, a straight line is obtained. The bond length of C-Cl is taken to be about the same as that for C-C bond. It is concluded that the inductive effect decreases inversely with the square of the distance between the polar group and the reacting C-H bond.

Microfilm $2.00; Xerox $3.80. 70 pages.

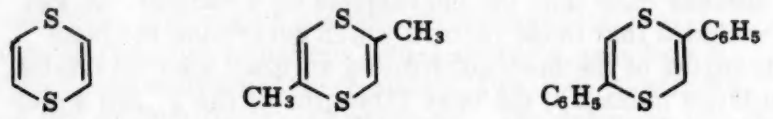
2,5-DIMETHYL-1,4-DITHIADIENE.

(L. C. Card No. Mic 59-3782)

Gwendolyn Lee Olson Mayo, Ph.D.
University of Minnesota, 1958

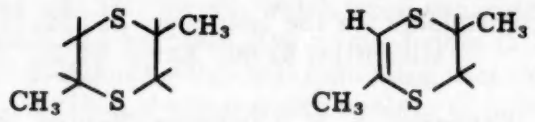
Adviser: W. E. Parham

1. 2,5-Dimethyl-1,4-dithiadiene (II), the first known example of an alkyl substituted dithiadiene, has been prepared and characterized.



I II III

2. Other new derivatives of the dimethyldithiane ring system (IV) and the dimethyldithiene ring system (V) are reported.



IV V

3. Certain chemical reactions have been explored, with particular attention devoted to comparison of the chemical behavior of II to I and III. These reactions include:
   a. oxidation
   b. thermal stability
   c. nitration
   d. bromination
   e. chlorination
   f. acylation
   g. formylation
   h. mercuration
   i. polymerization in the presence of Lewis acids
4. No successful electrophilic substitution reactions of II were realized; thus, in its chemical behavior, II is similar to I and dissimilar to III.
5. Previous explanations for the difference in aromatic character of III and I, based on steric effects of the attached phenyl groups in III, consequently find little support. The greater aromatic character of the heterocyclic ring in III must therefore be a result of the conjugative effects of the phenyl groups.

Microfilm $2.00; Xerox $4.80. 92 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

THE EFFECT OF SUBSTITUENT GROUPS ON REARRANGEMENT OF ALLYLIC HALIDES DURING AMINATION.

(L. C. Card No. Mic 59-3855)

Kenneth Laurence McHugh, Ph.D.
The University of Connecticut, 1959

The major objective of this investigation was to determine the proportion of normal to rearranged substitution products obtained from the amination with a secondary amine of a series of structurally related secondary allylic chlorides. The allylic chlorides which were included in this study were chosen on the basis of their structural relationship to 3-chloro-5-methoxy-1-pentene, whose anomolous behavior during amination reactions had already been extensively studied in this laboratory.

Secondary allylic chlorides of the structure $RCHClCH=CH_2$ have been found to be unusually prone to rearrangement in their reactions with secondary amines. Until the amination of 3-chloro-5-methoxy-1-pentene with dimethylamine in a polar solvent was studied and was found to produce a mixture of both normal and rearranged products, all such secondary allylic chlorides had been reported to give exclusively rearranged products. The anamolous behavior of this chloro ether was later made use of to demonstrate that the basicity and steric requirements of the aminating reagent are not important factors in determining the extent of rearrangement. Furthermore, 3-chloro-1-pentene, 3-chloro-1-butene, and 3,4-dichloro-1-butene were found to produce exclusively rearranged products under the same conditions which resulted in the formation of a mixture of products from the chloro ether.

In the present investigation, five secondary allylic chlorides were synthesized and were treated with dimethylamine in a polar solvent under the same conditions which Brill used for the amination of 3-chloro-5-methoxy-1-pentene. All five of the compounds studied produced mixtures of normal and rearranged products. The ratio of normal

Results of the Amination of Allylic Chlorides of the Form $RCHClCH=CH_2$ with Dimethylamine

R	Normal	Rearranged	Yield
CH_3OCH_2	50%	50%	35%
$CH_3OCH_2CH_2CH_2$	65	35	60
$CH_2=CHCH_2$	45	55	75
$C_6H_5CH_2CH_2$	40	60	60
$HCOOCH_2CH_2$	80	20	38

to rearranged products can be seen to vary somewhat among the series and appears to indicate that the oxygenated functional groups markedly retard the formation of rearranged products while unsaturated hydrocarbon groups seem to display a somewhat lesser influence. The extent of rearrangement was not greatly different when the methoxy group was in the 4, 5, or 6 position in the allylic chloro ethers.

A theory is proposed to explain the unusual behavior of these allylic chloro ethers during aminations which is based on an earlier proposal that the overwhelming tendency of the secondary allylic chlorides to rearrange during amination was due, at least in part, to the formation of a hydrogen-bond between the departing and entering groups. A competing hydrogen-bond formation involving the ether oxygen is proposed which inhibits the formation of rearranged products. The theory cannot however explain the production of relatively large quantities of normal product from the aminations of the chloro hydrocarbons, in which no alternative hydrogen-bonding is possible. Indeed there does not seem to be any adequate explanation at this time for the fact that these unsaturated groups in the molecule effectively prevent the total rearrangement during amination. Microfilm $2.00; Xerox $5.00. 100 pages.

THE RING-CHAIN TAUTOMERISM OF AROYLHALOGENOACRYLIC ACIDS.

(L. C. Card No. Mic 59-4238)

Henry Moncure, Jr., Ph.D.
University of Virginia, 1959

A study of the methods of synthesis and the ring-chain tautomerism of several aroylhalogenoacrylic acids has been made. Complete parallelism of reactivity has been observed in the p-bromobenzoyl and benzoyl halogenoacrylic acids. The trans addition of bromine to the trans aroylacrylic acids is favored in acetic acid; cis addition occurs predominantly in less polar solvents. Stereospecific trans dehydrobromination of the diastereoisomeric dibromides has been accomplished, yielding the respective cis and trans aroyl-beta-bromoacrylic acids. A concerted elimination is the postulated mechanism.

In the mesitoylacrylic acid dibromides, stereospecific dehydrobromination is not observed, and an enolization mechanism is postulated. It is considered that steric effects of the ortho methyl groups cause a sudden ejection of the hydrogen by successful attack of the base, creating a charged intermediate before a slower loss of the bromine can occur.

The benzoyl and p-bromobenzoyl acrylic acid chlorides are cyclic; alcoholysis in the presence of silver ion yields the cyclic ester, but in the absence of silver ion, open-chain esters are produced. The open chain esters are the stable forms.

The acid chloride of cis- mesitoyldibromoacrylic acid, however, is shown to be open chain; alcoholysis in the presence of silver ion gives a cyclic ester in which the acid chloride chlorine and one bromine are retained. In the absence of silver ion the corresponding open-chain bromochloroester is formed. An internal displacement mechanism for the halogen exchange is postulated.

The cyclic bromochloro ester is remarkably resistant to the action of methanolic hydrogen chloride, but under prolonged treatment it is converted to the thermodynamically more stable open-chain form.

It is postulated that the observed preparation at will of either cyclic or open-chain esters from both open-chain and cyclic acid chlorides depends upon competing mechanisms of alcoholysis. One mechanism is a conjugate-addition-elimination involving the acid chloride carbonyl and can only yield open-chain esters; the second involves formation of a cationic intermediate by loss of a chloride ion.

The reactions under the influence of silver ion are best explained in terms of a cationic intermediate with the structure of the product dependent upon the favored structure of this ion. The cyclic ester is the labile form, whereas the cyclic ion is evidently the stable form.

An infrared and ultraviolet spectrophotometric study of ring-chain tautomerism is presented. The benzoyl and p-bromobenzoyl-beta-bromoacrylic acids are shown to be 30% to 50% cyclic in solution.

The effect of nuclear substituents upon cyclization is shown by the study of cis-p-methoxybenzoyl-beta-bromoacrylic acid, which was prepared by the stereospecific synthesis. It does not exhibit detectable cyclization in solution. It was possible, however to prepare the cyclic ester of the p-methoxy acid by the alcoholysis of the acid chloride in the presence of silver ion.

Microfilm $3.05; Xerox $10.60. 236 pages.

A STUDY OF THE VAPOR PHASE ABSORPTION SPECTRA OF A SERIES OF ALIPHATIC KETONES IN THE ULTRAVIOLET REGION.

(L. C. Card No. Mic 59-984)

William Randolph Mountcastle, Jr., Ph.D.
University of Alabama, 1958

The ultraviolet absorption spectra of the compounds in the vapor phase, Table I, have been determined and a maximum has been assigned to each compound.

TABLE I. COMPOUNDS STUDIED IN THIS INVESTIGATION

Compound	Wavelength - A
2-Propanone	2770
2-Butanone	2780
3-Pentanone	2790
3-Methyl-2-butanone	2830
2,4-Dimethyl-3-pentanone	2865
3,3-Dimethyl-2-butanone	2845
2-Hexanone	2785
2,2-Dimethyl-3-pentanone	2880
2,2,4-Trimethyl-3-pentanone	2900
2,2,4,4-Tetramethyl-3-pentanone	2970
1-Chloro-2-propanone	2885
1,1-Dichloro-2-propanone	2945
1,3-Dichloro-2-propanone	3000
1,1,1-Trichloro-2-propanone	2810*
1,1,3,3-Tetrachloro-2-propanone	3005
1,1,1,3-Tetrachloro-2-propanone	2985
1,1,1,3,3-Pentachloro-2-propanone	2980
1,1,1,3,3,3-Hexachloro-2-propanone	2975
Methyl Cyclopropyl Ketone	2760
Dicyclopropyl Ketone	2760
Ethyl Acetoacetate	2750*
Cyclopentanone	3000
Cyclohexanone	2890

*Spectrum dominated by Enol form of the compound.

In so far as can be determined, the spectra of 2,4-dimethyl-3-pentanone; 2,2-dimethyl-3-pentanone; 2,2,4-trimethyl-3-pentanone; 1,3-dichloro-2-propanone; 1,1,1-trichloro-2-propanone; 1,1,3,3-tetrachloro-2-propanone; 1,1,1,3-tetrachloro-2-propanone; 1,1,1,3,3-pentachloro-2-propanone; and 1,1,1,3,3,3-hexachloro-2-propanone have not been investigated previously.

In addition, the principal peaks of the fine structure of cyclopentanone, occurring in the carbonyl band, and cyclohexanone, occurring in the enol band, have been determined. The cyclopentanone fine structure has been reported previously while that of the cyclohexanone has not been investigated. The assignments for the cyclohexanone fine structure are listed below:

TABLE II. FINE STRUCTURE FOR THE ENOL BAND OF CYCLOHEXANONE

Wavelength - A
2414
2471
2530
2584
2600

A theoretical treatment has been made of the spectrum of each compound. The conclusions drawn from this treatment are as follows:

1. In the alkyl ketones "B" strain and strain of the bond angles on the carbonyl carbon (a form of "B" strain itself) are the dominant factors behind the "red shifts" observed in the more complex ketones. This is substantiated by the fact that cyclohexanone, which is a relatively strainless structure, absorbs at a lower wavelength than cyclopentanone, which is strained at the carbonyl carbon.

2. Positive inductive effect, hyperconjugation effect, and mass effect are secondary factors.

3. The spectra of the chloroketones is affected by the strains operative in the alkyl ketones and also by the strong negative inductive effect of the chlorine atoms. In addition, the coulombic repulsion of the chlorine atoms, symmetrically substituted in the ketones, give an added strain to the carbonyl bond angle.

4. A resonance form has been postulated for the polychlorinated ketones. This form contains a vinyl and an allyl type chlorine atom, which results in an over-all increase in the length of the resonant system.

5. The shift to shorter wavelengths of the maxima of the cycloalkyl ketones has been reported by other observers. It is observed in this investigation. No satisfactory explanation has been offered for this observation. Microfilm $2.70; Xerox $9.40. 207 pages.

KINETICS AND MECHANISM OF THE ACID-CATALYZED HYDROLYSIS OF ARENEBORONIC ACIDS.

(L. C. Card No. Mic 59-3433)

Kevork Vartan Nahabedian, Ph.D.
University of New Hampshire, 1959

The kinetics of the acid-catalyzed hydrolysis of nine areneboronic acids (X = p-CH_3O, p-CH_3, p-F, H, p-Br, m-F, m-Cl, m-CF_3 and m-NO_2) have been studied. The reaction is represented by the equation

$$XC_6H_4B(OH)_2 + H_2O \xrightarrow{HA} C_6H_5X + H_3BO_3$$

and, in a given medium, follows first order kinetics.

All nine substrates have been studied in aqueous sulfuric acid at a temperature of 60°C. These substrates differ sufficiently in reactivity so that at this temperature the region of acidities 3-97% H_2SO_4 by weight could be covered continuously. For X = p-CH_3O, p-CH_3, p-F, H, p-Br and m-NO_2 the pseudo first-order rate constants are correlated by an equation of the type

$$\log k_{obs.} = -C_1H_0 + C_2$$

where H_0 is Hammett's acidity function. Values of C_1 vary between 0.84 and 1.10. For X = m-F and m-Cl an equation of this type correlates the change in $k_{obs.}$ below $-H_0 = 5.0$ and above $-H_0 = 5.5$, but the values of C_1 for the two separate regions are markedly different. In the case of m-F, C_1 changes from 0.72 to 1.0; for m-Cl the change is from 0.65 to 1.0. Activation parameters have been obtained for X = p-CH_3O, H and m-F. The solvent hydrogen isotope effects for X = p-CH_3O, p-CH_3, p-F and m-F have been determined at 60°C.; for a given percent by weight acid the value of k_H/k_D varies between 1.7 and 3.0. In 6.31M sulfuric acid solutions varying in solvent hydrogen isotope composition, the rate of hydrolysis of p-methoxybenzeneboronic acid at 25°C. is linearly dependent on the atom fraction of deuterium.

Rates in aqueous perchloric and phosphoric acids have also been measured. The rates in perchloric acid are correlated by the acidity function while those in phosphoric acid are not.

The hydrolysis of p-methoxybenzeneboronic acid in the solvent system 94.8% formic acid -4% ethylene glycol dimethyl ether -1.2% water has been shown to be general acid-catalyzed.

All of these findings are consistent with an A-S_E2 type mechanism in which the rate-determining step is the formation of a σ-complex.

Microfilm $2.00; Xerox $6.60. 136 pages.

THE SYNTHESIS, DECOMPOSITION AND INITIATION EFFICIENCY OF PEROXYCARBAMATES.

(L. C. Card No. Mic 59-3632)

Eugene L. O'Brien, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: F. Marshall Beringer

The aim of this research was to contribute to the chemistry of organic peroxides by a study of the kinetics of decomposition of peroxycarbamates and their use as initiators of polymerization.

By the reaction of hydroperoxides with isocyanates the following peroxycarbamates have been prepared: cumyl N-phenylperoxycarbamate, t-butyl N-α-naphthylperoxycarbamate, t-butyl N-phenylperoxycarbamate and its phenyl-substituted derivatives. The infrared and ultraviolet spectra of these compounds have been recorded and summarized.

The kinetics of the decomposition of t-butyl and cumyl N-phenylperoxycarbamates were of first order, with little or no induced decomposition, and their rates of decomposition were measured over a 30° range. On the other hand, t-butyl N-α-naphthylperoxycarbamate showed strong induced decomposition, and no rate constants could be determined.

Cumyl N-phenylperoxycarbamate decomposed at 67° about ten times as fast as the t-butyl ester.

First order rate constants for the decomposition of substituted t-butyl N-phenylperoxycarbamates generally increased with the electron-releasing power of the substituents and were in the order: m-CH_3 > H > p-Cl > m-Cl > p-NO_2 > m-NO_2. Plots of log k versus σ(L. P. Hammett) or σ^+ (H. C. Brown) had slopes (rho) of -2.15. This is in accord with the experimental lack of success in preparing t-butyl N-phenylperoxycarbamates bearing electron-releasing p-CH_3 or p-CH_3O groups.

From studies of the polymerization of styrene initiated by peroxycarbamates initiation efficiencies were calculated: t-butyl N-phenylperoxycarbamate, 0.95; cumyl N-phenylperoxycarbamate, 0.73. t-Butyl N-α-naphthylperoxycarbamate showed a wide variation of initiation efficiency with catalyst concentration. As carbon dioxide evolution was nearly quantitative, it is concluded that t-butoxy and phenylamino radicals efficiently initiated chains while cumoxy and α-naphthylamino radicals were less efficient. Microfilm $2.00; Xerox $4.60. 90 pages.

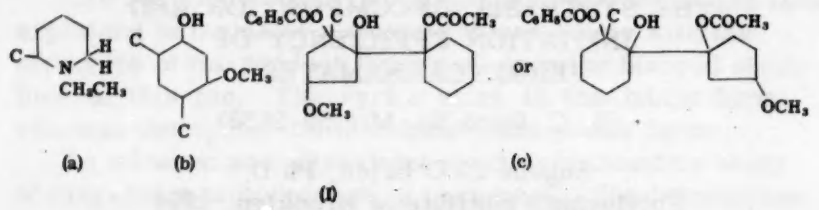
ACONITINE, AN INVESTIGATION OF STRUCTURE.

(L. C. Card No. Mic 59-4031)

William Wolfgang Paudler, Ph.D.
Indiana University, 1959

A partial structure (I) of the alkaloid, aconitine - $C_{19}H_{19}$ (N-CH_2CH_3)(-OH)$_3$(-OCH_3)$_4$(-$OCOCH_3$)(-$OCOC_5H_5$) - has been established by degradative and physico-chemical studies.

The potassium permanganate oxidation of aconitine yields two pairs of isomeric neutral material, aconitam ($C_{24}H_{45}NO_{12}$), an N-ethyl-piperidone, and oxoaconitam



(I)

($C_{34}H_{43}NO_{12}$), a keto-N-ethylpiperidone, as well as oxonitine ($C_{34}H_{45}NO_{12}$), an N-acetylpiperidine, and oxooxonitine ($C_{34}H_{43}NO_{12}$), a keto-N-acetylpiperidine. Aconitam and oxonitine can be converted to their oxo- analogs.

Careful acetylation of aconitine yields a chromic anhydride-resistant monoacetylaconitine ($C_{36}H_{49}NO_{12}$), which can be oxidized to monoacetylaconitam ($C_{36}H_{47}NO_{13}$) and monoacetyloxonitine ($C_{36}H_{47}NO_{13}$). These materials are also obtainable from aconitam and oxonitine, respectively. Thus, monoacetylation with acetic anhydride occurs on the lone secondary hydroxyl group of aconitine.

Aconitine is oxidized by chromic anhydride to the ketone, aconinoline, which readily loses methanol to form aconitoline ($C_{33}H_{41}NO_{10}$). The infrared and ultraviolet spectra of this material show it to be an alpha,beta-unsaturated cyclohexenone with no substituents in the alpha and gamma position. Its inertness towards enol formation indicates substitution on the gamma and epsilon carbon atoms of the ring, by at least one carbon atom, if either the gamma or epsilon positions are not bridge-heads. The pK_a of aconitoline and of its palladium-on-charcoal reduction product, dihydroaconitoline, as well as the infrared and ultraviolet carbonyl shifts involved in the formation of aconitoline perchlorate, place the carbonyl group in the vicinity of the nitrogen atom.

Saponification of aconitoline yields the same product as is obtained by chromic anhydride oxidation of aconine ($C_{25}H_{41}NO_9$), an experiment which shows that aconine contains only one secondary hydroxyl group.

The pyrolysis of aconitine yields pyroaconitine ($C_{32}H_{43}NO_8$) and acetic acid. Since triacetylaconitine cannot be pyrolyzed, the pyrolysis of aconitine involves a free hydroxyl group. It has been shown that a reasonable interpretation of the pyrolysis of aconitine involves a thermal pinacol rearrangement of a tertiary carbinol group and an adjoining acetoxyl-substituted carbon. Monoacetylaconitine is pyrolyzed to the same monoacetylpyroaconitine as is obtained by careful acetylation of pyroaconitine; thus, the most readily acetylated hydroxyl group of aconitine is not involved in the pyrolytic mechanism. The carbonyl group in pyroaconitine is made spectrally evident by the formation of pyroaconine ($C_{25}H_{39}NO_8$). The presence of a hydroxyl group adjacent to the carbonyl grouping also becomes evident in this compound.

Aconitine is inert towards periodic acid, while benzoylaconine ($C_{32}H_{45}NO_{10}$) consumes one and aconine consumes two moles of the oxidizing agent. That aconine contains a vicinal triol system is shown by the presence of an alpha-hydroxy ketone in pyroaconine. Since the secondary hydroxyl group is not involved in the formation of the pyro-compounds, it must be a tertiary hydroxyl that is adjacent to the acetoxyl group. From these data one can deduce the structural units Ic.

The periodic acid oxidation product of benzoylaconine contains an alpha,beta-unsaturated cyclopentenone, as well as a cyclohexanone (evidenced by its ultraviolet and infrared spectra). From these results, the structural unit I,c can be deduced.

A study of the basicities of monoacetyl-, diacetyl- and triacetylaconitine, as well as of aconine and pentaacetylaconine, place the various hydroxyl groups within definite relative positions to the nitrogen atom in aconitine and will permit the exclusion of many possible structural arrangements for aconitine.

Microfilm $2.20; Xerox $7.80. 167 pages.

REDUCTION OF KETOXIMES BY LITHIUM ALUMINUM HYDRIDE.

(L. C. Card No. Mic 59-3434)

Anthony Edward Petrarca, Ph.D.
University of New Hampshire, 1959

The reaction of ketoximes with lithium aluminum hydride was studied quantitatively by analyzing the amines obtained from the reduction of ketoximes and their derivatives by potentiometric titration. Through such a study it was possible to determine the effect of several structural features on the course of the reaction of aromatic ketoximes and their derivatives (I) with lithium aluminum hydride, wherein the expected primary amine (II) is usually accompanied by an isomeric secondary amine (III) resulting from reductive rearrangement.

$$\underset{\text{I}}{ArC(=NOR')R} \xrightarrow{LiAlH_4} \underset{\text{II}}{ArCH(NH_2)R} + \underset{\text{III}}{ArNHCH_2R}$$

Electron-releasing substituents in the para position of acetophenone oximes caused, simultaneously, a decrease in the overall rate of reduction and an increase in the relative amount of reductive rearrangement product. No such correlation was possible for the effect of substituents in the ortho position; while each of the three ortho-substituted compounds studied gave decreased relative amounts of the rearrangement product than did the corresponding para-substituted compounds, two of them, the o-methyl- and o-chloro-substituted acetophenone oximes, exhibited a marked decrease in the rate of reduction, but the third, o-methoxyacetophenone oxime underwent reduction at an accelerated rate. The behavior of the first two compounds was undoubtedly due to steric inhibition of the reaction by the bulky o-methyl and o-chloro substituents; whereas, the anomalous behavior of the third was probably due to the formation of a coordinated complex between the o-methoxy substituent and aluminum hydride, which could thus facilitate the reaction intramolecularly.

The methyl ethers of several substituted acetophenone oximes underwent reduction at slower rates and gave smaller amounts of the rearrangement product than did the corresponding oximes. This seemed to indicate that the anion first formed by removal of the active hydrogen from an oxime by lithium aluminum hydride plays an important part in the reaction. The possibility that the aluminum hydride coordination complex formed with this anion might function as a more powerful reducing agent was ruled out, unless it did so intramolecularly, by a kinetic study which showed that the reaction was first order in oxime. In the kinetic study, a variation in the ratio of products with time was also observed, suggesting that the

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products are formed by several reaction paths, or from several intermediates (or transition states).

The reduction of the two isomers of isobutyrophenone oxime showed that the rearrangement accompanying the lithium aluminum hydride reduction is not stereospecific, for approximately the same product mixture was obtained from both oxime isomers. The oximes were not isomerized by treatment with lithium aluminum hydride, and the anti-phenyl isomer underwent reduction and rearrangement at a slower rate than the syn-phenyl isomer, thus precluding the possibility of preliminary isomerization and rearrangement before reduction to account for the major product, N-isobutylaniline.

The most promising explanation of the experimental results is offered by a reaction path which involves an oxazirane transition state. It is suggested that this is the main path by which reductive rearrangement occurs, but reduction must also occur concurrently by other reaction paths to account for the variation in the ratio of products with time. Microfilm $2.00; Xerox $4.40. 83 pages.

THE SYNTHESIS AND SOME REACTIONS OF 4-METHYL-3-PYRIDINECARBOXALDEHYDE.

(L. C. Card No. Mic 59-3867)

Daniel Anthony Scola, Ph.D.
The University of Connecticut, 1959

The purpose of this investigation was to devise a synthetic route for the preparation of 4-methyl-3-pyridinecarboxaldehyde and to study its chemical and physical properties. It was believed that this compound could be used as a precursor in isoquinoline syntheses.

The synthesis of pyridine compounds by ring closure of two or more fragments has been known for many years. While other methods involving operations on a preformed pyridine nucleus were tried, the former appeared to be the most satisfactory for the synthesis of 3-substituted 4-methylpyridines.

Procedures are described for the synthesis of several 3-substituted-4-methylpyridines and other unknown pyridine compounds. The N-oxides of six 3-substituted-4-methylpyridines are also described and reported but were not analyzed. A list of compounds is shown below.

3-cyano-2,6-dichloro-4-methylpyridine
4-methyl-3-pyridinecarboxamide and its hydrochloride
ethyl 4-methyl-3-pyridinecarboxylate hydrochloride
4-methyl-3-pyridinecarboxhydrazide
3-(hydroxymethyl)-4-methylpyridine, its picrate and hydrochloride
1,2-bis(4-methyl-3-pyridinoyl) hydrazine
4-methyl-3-pyridinecarboxaldehyde
4-methyl-3-pyridinecarboxaldehyde 2,4-dinitrophenylhydrazone
4-methyl-3-pyridinecarboxaldehyde semicarbazone
4-methyl-3-pyridinecarboxaldehyde dimethylhydrazone
4-methyl-3-pyridinecarboxaldehyde oxime
cyclic ethylene acetal of 4-methyl-3-pyridinecarboxaldehyde, [2-(4-methyl-3-pyridyl)-1,3-dioxolane]
ethyl (4-methyl-3-pyridal)malonate, [1,1-dicarboethyoxy 2-(4-methyl-3-pyridyl)ethylene]
3-(aminomethyl)-4-methylpyridine (not analyzed)
4-methyl-3-pyridinecarboxhydrazide-N-oxide
ethyl 4-methyl-3-pyridinecarboxylate-N-oxide
4-methyl-3-pyridinecarboxamide-N-oxide
4-methylpyridinecarboxylic acid-N-oxide
3-cyano-4-methylpyridine-N-oxide
3-(hydroxymethyl)-4-methylpyridine-N-oxide

Acylation studies of ethyl (4-methyl-3-pyridal)malonate, 2-(4-methyl-3-pyridal)-1,3-dioxolane and 4-methyl-3-pyridinecarboxaldehyde in an attempt to prepare 6,7-disubstituted isoquinolines were not successful.

Suggestions for further study toward the synthesis of 6,7-disubstituted isoquinolines have been made.

Microfilm $2.00; Xerox $5.40. 108 pages.

3-SUBSTITUTED THIOPHENE MANNICH BASES AND DERIVATIVES.

(L. C. Card No. Mic 59-4046)

Cecil Marvin Upton, Ph.D.
Indiana University, 1959

Mannich, Blicke and Denton demonstrated the facility of preparation, and the local anesthetic and antispasmodic activity of beta-amino ketone Mannich bases and derivatives. Pharmacologically active Mannich base derivatives prepared were beta-amino alcohols, ester derivatives of these alcohols and quaternary ammonium derivatives of these compounds.

By a six step reaction sequence, 3-acetothienone was prepared from 3-methylthiophene in a 53 per cent over-all yield and used as a starting material in this study. In the presence of N-bromosuccinimide and benzoyl peroxide, 3-methylthiophene was converted to 3-thenyl bromide and isolated as its hexamine salt. Steam distillation of the latter in a 50 per cent acetic acid solution gave 3-thenaldehyde which was oxidized to 3-thenoic acid using silver oxide. After conversion to the acid chloride, reaction with dimethylcadmium in a benzene solution gave 3-acetothienone.

Paraformaldehyde and such secondary amine salts as piperidine, dimethylamine and diethylamine hydrochlorides were reacted with 3-acetothienone in 1-butanol to produce Mannich bases in 81, 49 and 17 per cent yields respectively, while reaction with di-n-butylamine hydrochloride failed to yield an isolatable product. The higher reaction temperature and reduced reaction time possible with 1-butanol resulted in somewhat improved yields compared to preparation in ethanol. For purposes of pharmacological comparisons in the same tests, both 2-thiophene and phenyl analogs of the 3-thiophene piperidyl Mannich base were prepared in 74 and 81 per cent yields respectively.

The methobromides of β-(N-piperidyl)-3-propiothienone, β-(N-piperidyl)-2-propiothienone and β-(N-piperidyl)-propiophenone were readily prepared in 63, 62 and 57 per cent yields respectively by a two week reaction period of the free Mannich bases in an ethereal solution with an eight fold excess of methyl bromide. These quaternary salts were somewhat hygroscopic and β-(N-piperidyl)-propiophenone methobromide was isolated as a hemihydrate.

Catalytic hydrogenation of β-(N-piperidyl)-propiophenone hydrochloride in aqueous solution to its corresponding secondary alcohol using 30 per cent Palladium-Charcoal

catalyst was accomplished in a 91 per cent yield. The thiophene Mannich bases were chemically reduced to the corresponding secondary alcohols using lithium aluminum hydride in an ethereal solution. Both 3-(N-piperidyl)-1-(3'-thienyl and 2'-thienyl)-1-propanol were isolated as hydrochloride salts in a nonhydrated state in 88 and 90 per cent yields respectively. However, the extremely hygroscopic amino alcohol salt, 3-dimethylamino-1-(3'-thienyl)-1-propanol hydrochloride was isolated as the monohydrate only after careful protection against moisture. The quaternary ammonium salts resulting from treatment of these alcohols with methyl bromide were too hygroscopic for isolation in an anhydrous condition. Attempts to convert the 2- and 3-thiophene Mannich bases to their corresponding phenyl substituted tertiary alcohol derivatives were not successful though β-(N-piperidyl)-propiophenone was readily converted with both phenyllithium and phenylmagnesium bromide in 32 and 28 per cent yields respectively.

The ester hydrochlorides, 3-(N-piperidyl)-1-(3'-thienyl and 2'-thienyl)-1-propyl acetate hydrochlorides and 3-(N-piperidyl)-1-phenyl-1-propyl acetate hydrochloride were prepared in 91, 88 and 89 per cent yields respectively by treatment of benzene solutions of the free precursor secondary alcohols with acetyl chloride. The free 3-thiophene and phenyl substituted esters were readily converted to their hygroscopic quaternary ammonium salt esters. However, reaction of 3-(N-piperidyl)-1-(2'-thienyl)-1-propyl acetate with methyl bromide unexpectedly gave an unsaturated quaternary salt due to elimination of acetic acid from the ester functionality.

By treatment of benzene solutions of the precursor amino alcohols with a benzene solution of benzoyl chloride, 3-(N-piperidyl)-1-(3'-thienyl and 2'-thienyl)-1-propyl benzoate hydrochlorides and 3-(N-piperidyl)-1-phenyl-1-propyl benzoate hydrochloride were prepared in yields of 81, 77 and 84 per cent respectively.

Microfilm $2.00; Xerox $5.20. 101 pages.

DIELS-ALDER REACTIONS OF DIPHENYLTHIOPHENE DIOXIDES.

(L. C. Card No. Mic 59-3638)

John Michael Whelan, Jr., Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: Charles G. Overberger

The aromatic character of the thiophene nucleus is destroyed by oxidation to the sulfone. The resulting thiophene-1-dioxides behave as cyclic dienes; in addition, sulfone activation of the double bonds contributes dienophile reactivity. The ring system is thus analogous to that of cyclopentadienone. The purpose of this research was to investigate the reactivity of thiophene-1-dioxides in the Diels-Alder reaction; in particular, to demonstrate the dimerization reaction shown by cyclopentadienones.

The previously known reaction product of 3,4-diphenylthiophene-1-dioxide and maleic anhydride was shown to be identical with that derived from 3,4-diphenyl-4-hydroxy-2-cyclopentenone and excess maleic anhydride; i.e. 7,8-diphenylbicyclo[2.2.2] oct-7-ene-2,3,5,6-tetracarboxylic dianhydride. The reaction proceeded by diene addition, loss of sulfur dioxide with regeneration of a cyclic diene, and diene addition of a second molecule of maleic anhydride. Rapid elimination of sulfur dioxide from the initial adduct was suggested by failure to isolate the bridge sulfonyl adduct from partially reacted mixtures, and confirmed by kinetic evidence.

Reaction of 3,4-diphenylthiophene-1-dioxide with acetylenedicarboxylic acid produced 4,5-diphenylphthalic anhydride. Reaction with phenylacetylene or with α-acetoxystyrene produced 1,2,4-triphenylbenzene, as did reaction of 2,5-diphenylthiophene-1-dioxide with phenylacetylene. An erroneous description of 1,2,4-triphenylbenzene in the literature was corrected.

3,4-Diphenylthiophene-1-dioxide has been shown to undergo a Diels-Alder reaction in which it acted as both diene and dienophile. The resulting dimer immediately lost one molecule of sulfur dioxide to form 3,3a,5,6-tetraphenyl-3a,7a-dihydrobenzothiophene-1-dioxide. This structure was established by pyrolysis to form 1,2,4-triphenylbenzene, phenylacetylene, and sulfur dioxide; by Raney nickel desulfurization to form 1,2,4-triphenylbenzene and ethylbenzene; and by formation of a maleic anhydride adduct.

The product of Diels-Alder dimerization was shown to be much less reactive than the analogous carbonyl compound (from diphenylcyclopentadienone dimerization and decarbonylation).

Formation of 1,2,4,5-tetraphenylbenzene as a byproduct of the pyrolysis suggested that this compound is capable of isomerization through an intermediate valence tautomer containing a nine membered, fully conjugated sulfone ring (3,4,6,7-tetraphenylthionin-1-dioxide), to 3a,4,6,7-tetraphenyl-3a,7a-dihydrobenzothiophene-1-dioxide.

On attempted dimerization of 2,5-diphenylthiophene-1-dioxide, all of the sulfur dioxide was lost. Kinetic analysis of the reaction suggested that dimerization had occurred, followed by rapid thermal decomposition of the dimer.

These observations, as well as those published by several other investigators during the course of this work, demonstrated the reactivity of the thiophene-1-dioxide ring system as a diene and as a dienophile in the Diels-Alder reaction. Microfilm $2.00; Xerox $5.40. 110 pages.

A STUDY OF SOME BASIC CARBINOLS: PYRIDYL CARBINOLS DERIVED FROM MANNICH BASES.

(L. C. Card No. Mic 59-3889)

Roger T. Wolfe, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: Alexander R. Surrey

A group of amine-substituted pyridyl carbinols has been prepared and made available for pharmacological screening. The compounds were synthesized by the reaction of pyridyllithium reagents with various Mannich bases derived from benzyl ketones.

Unsuccessful attempts were made to carry out Mannich reactions with phenyl 2- and 4-picolyl ketones and with benzyl 3- and 4-pyridyl ketones.

The spectra and reactions of phenyl 2-picolyl ketone

indicate that a stable enol form exists in non-polar solvents while considerable keto form is present in ethanol.

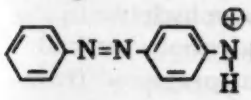
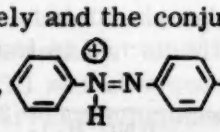
The inability of the Mannich reaction to proceed in ethanol suggests that an enol which is free to hydrogen-bond with another reacting species such as a methylolamine may be a prerequisite for aminomethylation.

Microfilm $2.00; Xerox $4.00. 75 pages.

THE BASICITIES OF SUBSTITUTED AZOBENZENES.

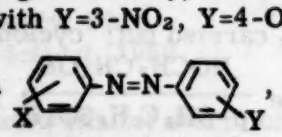
(L. C. Card No. Mic 59-3430)

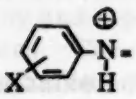
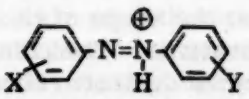
Si-Jung Yeh, Ph.D.
University of Cincinnati, 1959

The basicity of 4-dimethylaminoazobenzene (I) and its derivatives has been the subject of much discussion for many years, and the interest has been focused on the structure of the conjugate acid of (I) in acidic media. The following three controversial postulated have been made by previous workers; (a) the first proton adds to the amino-nitrogen exclusively to form an ammonium ion,  (II), (b) the first proton adds to one azo-nitrogen atom exclusively and the conjugate acid, accordingly, is an azonium ion,  (III), (c) the conjugate acid resulted upon addition of the first proton to (I) is a tautomeric mixture of (II) and (III).

A systematic investigation was carried out in an attempt to settle these controversial postulates concerning the structure of the conjugate acid of (I). The scope of the study includes the following three main parts; (1) the effect of substituents on the basicities of substituted azobenzene, (2) estimation of tautomeric equilibrium constant, K_T for the tautomeric mixtures, (II) and (III) in equilibrium and (3) the spectra of substituted azobenzenes.

(1) The effect of substituents on the basicities of substituted azobenzenes.

The effect of substituents on the basicities of monosubstituted azobenzenes was first studied by Jaffé and Gardner who have established a new H_0' function covering 20 to 55 wt.% H_2SO_4 contents, based on an arbitrary standard, for the calculation of pK's of the azo-compounds in a solvent system consisting of 20 vol.% EtOH and 80 vol.% H_2SO_4-H_2O mixtures. In order to connect the H_0' function to the pH scale and to extend it to higher acidity, three series of disubstituted azobenzenes with Y=3-NO_2, Y=4-OCH_3 and Y=4-OH in the general formula  , were prepared and the concentration ratios of the free bases, C_B to the conjugate acids C_{BH^+} were measured by the spectrophotometric method in a mixed solvent system mentioned above. The revised H_0' function is considerably different from the H_0 function, i.e. H_0' increases much faster than H_0 with the increase in H_2SO_4 content at higher acidity.

The pK's of all azo-compounds were calculated based on the revised H_0' function. Analysis of reaction constant for the protonation of azo-linkage showed that the azo-linkage of both mono- and disubstituted azobenzenes can be treated as a single reaction center, i.e. one basic center, and that it seems unlikely that tautomers,  and  exist after the proton is added to the substituted azobenzenes. Thus, the conjugate acids of substituted azobenzenes may be represented more likely by the structure in which the proton is not bonded to either nitrogen atom exclusively but shared by both nitrogen atoms, and the position of the proton varies from series to series depending on the substituents Y.

The transmission of electronic effects of substituents, X through the azo-linkage was studied by comparing the reaction constants for the dissociations of substituted phenols. It is interesting to note that the effectiveness of the transmission of electronic effect through the phenylazo-group is approximately one third that of ethylene linkage.

(2) Estimation of K_T for tautomers (II) and (III) in an equilibrium. ($K_T = [III]/[II]$)

Two ways to calculate the K_T were proposed.

(a) Estimation of K_T in the solvent system consisting of 20 vol. % EtOH and 80 vol.% H_2SO_4-H_2O mixtures.

Based on the knowledge obtained in (1), K_T was estimated, by the application of the Hammett equation, to be 2.6-2.8 in favor of species (III).

(b) Estimation of K_T in aqueous sulfuric acid solution.

Assuming that the pK of p-phenylazo-N,N,N-trimethylanilinium ion is the same as that of p-phenylazo-N,N-dimethylanilinium ion, K_T was estimated to be 3.0. The calculation based on the spectral data also led to the same results. Thus, it appears unequivocally established that the first conjugate acid of (I) is a mixture of (II) and (III) in the equilibrium, and the equilibrium constant is the order of 3.

(3) The spectra of substituted azobenzenes

The general descriptions and brief analysis of the ultraviolet and infrared spectra of substituted azobenzene were discussed.

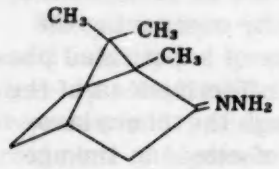
Microfilm $2.00; Xerox $6.40. 132 pages.

THE MERCURIC OXIDE OXIDATION OF HYDRAZONES.

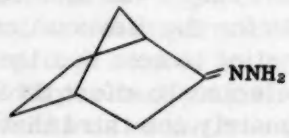
(L. C. Card No. Mic 59-4362)

Richard Logsdon Young, Ph.D.
Brown University, 1959

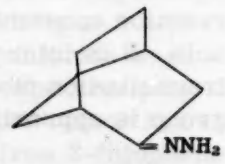
The oxidation of eight hydrazones (I-VIII) by mercuric oxide has been studied to test the scope of this method of preparing cyclopropane derivatives. The composition of the mixtures of olefins, tricyclic hydrocarbons, and other products which were isolated has been determined. Only camphor hydrazone gave a high yield of the desired product, tricyclene. The synthesis of three membered rings by oxidation of hydrazones is apparently useful only with bicyclic terpene hydrazones.



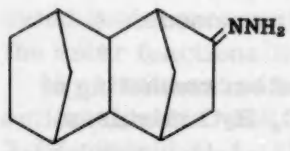
Camphor Hydrazone
I



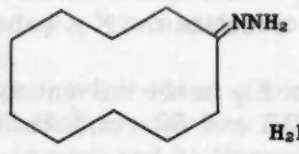
Norcamphor Hydrazone
II



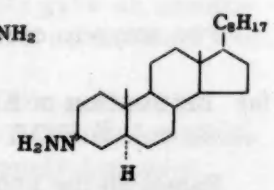
Bicyclo[2,2,2]-octanone Hydrazone
III



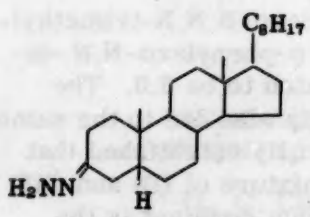
1,4,5,8-bis-Endomethylenedecalone Hydrazone
IV



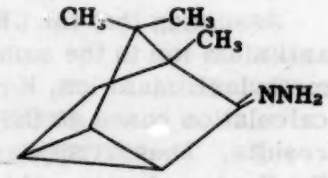
Cyclodecanone Hydrazone
V



Cholestanone Hydrazone
VI

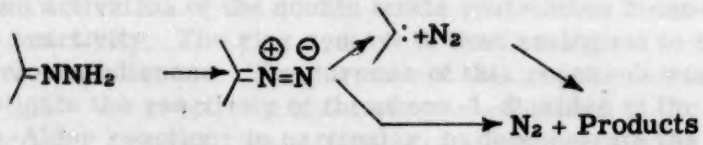


Coprostanone Hydrazone
VII

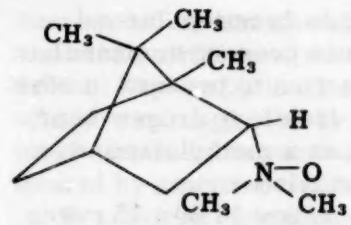


Isocyclenone Hydrazone
VIII

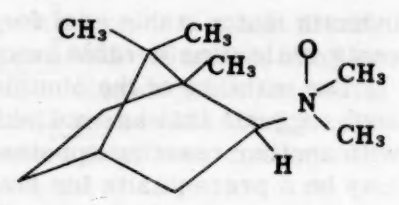
These reactions are discussed in terms of a mechanism which involves decomposition of a diazo alkane either to a carbene or directly to products as outlined below.



The thermal decomposition of dimethylbornylamine oxide (IX) and dimethylisobornylamine oxide (X) has been carried out and the composition of the resultant hydrocarbon mixture compared with results obtained by other investigators of this reaction and with results of other methods of elimination in this system.



IX



X

Microfilm $2.00; Xerox $5.20. 103 pages.

CHEMISTRY, PHARMACEUTICAL

AZABICYCLIC COMPOUNDS DERIVED FROM CYCLOHEPTANONE.

(L. C. Card No. Mic 59-3919)

Rupert Alden Covey, Ph.D.
University of Michigan, 1958

Salts of two azabicyclic ketones, 7-methyl-7-azabicyclo-[4.2.1]nonan-9-one (I) and 8-methyl-8-azabicyclo[4.3.1]-decan-10-one (II), were obtained during this investigation. Both ketones were reduced with sodium borohydride to the corresponding secondary alcohols. The alcohol obtained from I was converted into a benzilate, that prepared from II into a diphenylacetate.

The synthesis of I is indicated by the following scheme:

cycloheptanone $\xrightarrow[HN(CH_3)_2]{CH_2O}$ 2-dimethylaminomethylcycloheptanone (III) $\xrightarrow[(2)\ Br_2]{(1)\ HBr}$ 2-dimethylaminomethyl-7-bromocycloheptanone hydrobromide (IV) $\xrightarrow[(2)\ heat]{(1)\ NaOH}$ 7-methyl-7-azabicyclo[4.2.1]nonan-9-one methobromide (V) $\xrightarrow{heat}$ 7-methyl-7-azabicyclo[4.2.1]nonan-9-one (I).

The azabicyclic ketone II was prepared in the following manner: cycloheptanone $\xrightarrow[excess\ CH_2O]{CH_3NH_2.HCl}$ 8-methyl-8-azabicyclo[4.3.1]decan-10-one hydrochloride (II).

Unsuccessful attempts were made to obtain 2,5-dimethyl-2,5-diazabicyclo[4.3.2]undecan-10 one monomethobromide by treatment of 3-[N-methyl-N-(β-dimethylaminoethyl)]aminocycloheptanone (VI) with N-bromosuccinimide followed by attempted cyclization. After the bromination procedure had been carried out the material obtained, presumably the 7-bromo derivative, was subjected to an elevated temperature whereupon cyclization was expected to take place. Only an oil of an unknown nature was obtained.

In order to obtain VI, the following series of reactions was carried out: cycloheptanone $\xrightarrow{Br_2}$ 2-bromocycloheptanone $\xrightarrow[p\text{-}CH_3C_6H_4SO_3H]{HOCH_2CH_2OH}$ 2-bromocycloheptanone ethylene ketal $\xrightarrow{KOH}$ 2-cycloheptenone ethylene ketal $\xrightarrow[p\text{-}CH_3C_6H_4SO_3H]{CH_3COCH_3}$ 2-cycloheptenone $\xrightarrow{(CH_3)_2NCH_2CH_2NHCH_3}$ 3-[N-methyl-N-(β-dimethylaminoethyl)]aminocycloheptanone (VI).

Also unsuccessful were efforts to synthesize 8-methyl-8-azabicyclo[3.2.1]octan-6-one methobromide from

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

3-dimethylamino-7-bromocycloheptanone (VII). The manner in which VII was obtained is illustrated by the following scheme: cycloheptenone $\xrightarrow{(CH_3)_2NH}$ 3-dimethylaminocycloheptanone (VIII) $\xrightarrow[(2)\ NBS]{(1)\ HBr}$ 3-dimethylamino-7-bromocycloheptanone (VII).

It was expected that 6-methyl-6-azabicyclo[3.2.2]nonan-9-one methobromide might be obtained by the following series of reactions: 2-cycloheptenone $\xrightarrow[(2)\ H^+]{(1)\ NaCN}$ 3-cyanocycloheptanone $\xrightarrow[p\text{-}CH_3C_6H_4SO_3H]{HOCH_2CH_2OH}$ 3-cyanocycloheptanone ethylene ketal $\xrightarrow{LiAlH_4}$ 3-aminomethylcycloheptanone ethylene ketal (IX) $\xrightarrow[HCOOH]{CH_2O}$ 3-dimethylaminomethylcycloheptanone (X) $\xrightarrow[(2)\ heat]{(1)\ NBS}$ 6-methyl-6-azabicyclo[3.2.2]nonan-9-one methobromide (XI). Interaction of IX with formaldehyde and formic acid yielded a mixture of products which included 3-dimethylaminomethylcycloheptanol and possibly the desired ketone X. The mixture was treated with N-bromosuccinimide in the hope that the 7-bromo derivative of X would be formed. After bromination and subjection of the crude reaction mixture to heat, a product was obtained which, according to a complete analysis, was the ketone XI. However, its infrared spectrum showed absorption in the hydroxyl and not in the carbonyl region.

The ketones III, V, VI and VIII were reduced with hydrogen and platinum oxide to the corresponding secondary alcohols. The alcohols prepared from III, VI and VIII were converted into benzilates. Esters of the alcohol prepared from V could not be obtained. The bromo ketone IV was reduced with sodium borohydride to the bromo alcohol, which was converted into a diphenylacetate.

Attempts to form the bicyclic ketone II by the cyclization of 2,7-bis(dimethylaminomethyl)cycloheptanone dihydrochloride (XII) were unsuccessful. Compound XII was prepared from cycloheptanone by the action of dimethylamine hydrochloride and paraformaldehyde. The ketone XII was reduced with sodium borohydride to the corresponding alcohol, and both a benzilate and benzoate were obtained. Microfilm $2.00; Xerox $4.60. 90 pages.

THE USE OF LOW FREQUENCY SOUND IN THE ESTERIFICATION OF TWO STERICALLY HINDERED ACIDS.

(L. C. Card No. Mic 59-3838)

Robert Joseph Gerraughty, Ph.D.
The University of Connecticut, 1959

Ursolic acid and o-thymotinic acid exhibit steric hindrance, and direct esterification of the acids with alcohols was not possible. The objectives of this work were to prepare esters using low frequency ultrasound waves to overcome the hindrance.

Crude ursolic acid was purified by a new method. Some of the impurities were removed with various solvents and then the partially purified acid was decolorized in boiling alcoholic solution with Norit A, from which process the pure acid was obtained in yields of 30 per cent.

Using alcohols having up to four carbon atoms, a series of straight chain esters of both ursolic acid and o-thymotinic acid were prepared by exposing the acids with the corresponding alcohols at 39.1 K.C. frequency and a plate current of not more than 45 m.a. for two hours. The esters of ursolic acid were crystalline or microcrystalline in all cases. The esters of o-thymotinic acid were all pale yellow liquids with high boiling points.

Rates of esterification were determined for all eight esters under the same conditions of frequency and plate current. Aliquot portions were removed at 15 minute intervals and titrated with standard alkali. The free acid present could be calculated, and the amount of esterification was then apparent by difference.

The identities of the ursolic acid esters were established by preparation of acetyl esters which had been previously reported in the literature, by hydrolysis to obtain the acid, and by carbon and hydrogen determinations.

The identification of the o-thymotinic acid esters was established by determination of saponification equivalents and by carbon and hydrogen determinations.

The mechanism of esterification of ursolic acid was determined by reacting the ursolic acid with methyl and ethyl mercaptan using ultrasound. The results indicated that the ursolic acid acted as a hydrogen donor and not an hydroxyl donor since no thioesters were formed.

Attempts to prepare branched chain esters of both ursolic acid and o-thymotinic acid with various plate settings and varying lengths of time were all unsuccessful. This is believed to be due to the greater bulk of the entering branched chain as compared with the straight chain groups.

Attempts to further purify the o-thymotinic acid esters using a Todd column and a chromatographic method were unsuccessful. The esters remained pale yellow in color but their refractive indexes were not appreciably altered.

Microfilm $2.00; Xerox $3.80. 67 pages.

THE SYNTHESIS OF 2-AZETIDINONES (beta-LACTAMS).

(L. C. Card No. Mic 59-3926)

William Andrew Gould, Ph.D.
University of Michigan, 1958

It was found that seven amines- methyl-, isopropyl-, allyl-, cyclohexyl-, benzyl-, hexahydrobenzyl- and beta-phenylethylamine reacted with atropic acid (alpha-phenylacrylic acid) to form N-substituted alpha-phenyl-beta-aminopropionic acids. It seemed desirable to test the usefulness of these acids and their esters for the preparation of 2-azetidinones (beta-lactams), and the synthesis of 2-azetidinones then became our major interest.

The methyl, ethyl, isopropyl and benzyl esters of alpha-phenyl-beta-(benzylamino)propionic acid (obtained from atropic acid) were prepared and each ester was treated with either methylmagnesium iodide or ethylmagnesium bromide. The best yield (40%) of 1-benzyl-3-phenyl-2-azetidinone was obtained by the use of the isopropyl ester and ethylmagnesium bromide in the molecular ratio of 1:2. 3-Phenyl-2-azetidinone was obtained in 28% yield

when ethyl alpha-phenyl-beta-aminopropionate was allowed to react with ethylmagnesium bromide in the molecular ratio of 1:3.

During some preliminary experiments it was discovered that interaction of diazomethane and alpha-phenyl-beta-(benzylamino)propionyl chloride hydrochloride produced 1-benzyl-3-phenyl-2-azetidinone in 43% yield. 1-Hexahydrobenzyl-3-phenyl-(31%), 1-(beta-phenylethyl)-3-phenyl-(49%) and 1-isopropyl-3-phenyl-2-azetidinone (54%) were also prepared by this process in the indicated yields. It was found then that the diazomethane could be replaced by dimethylaniline, and by the use of this reagent fourteen 2-azetidinones were obtained:

2-Azetidinone			
1. 1-Methyl-3-phenyl-	(16%)	9. 1-Benzyl-4-methyl	(75%)
2. 1-Isopropyl-3-phenyl-	(80%)	10. 1-Benzyl-4-phenyl-	(75%)
3. 1-Allyl-3-phenyl-	(42%)	11. 1-Benzyl-3-cyclohexyl-	(81%)
4. 1-Cyclohexyl-3-phenyl-	(39%)	12. 1-Benzyl-4-cyclohexyl-	(79%)
5. 1-Benzyl-3-phenyl-	(66%)	13. 1-Benzyl-3-methyl-4-phenyl-	(90%)
6. 1-Hexahydrobenzyl-3-phenyl-	(76%)	14. 1-Benzyl-3,3-dimethyl-4-phenyl-	(91%)
7. 1-(beta-Phenylethyl)-3-phenyl-	(57%)		
8. 1-Benzyl-3-methyl-	(45%)		

In addition to the beta-amino acids used for the preparation of the first seven 2-azetidinones, others were required for the synthesis of the azetidinones 8-14. The known acids, beta-phenyl-beta-(benzylamino)propionic acid, alpha-methyl-beta-phenyl-beta-(benzylamino)propionic acid, and alpha,alpha-dimethyl-beta-phenyl-beta-(benzylamino)propionic acid were used for the synthesis of 10, 13 and 14, respectively, alpha-Methyl-beta-(benzylamino)propionic acid, obtained by the addition of benzylamine to methyl methacrylate and subsequent hydrolysis of the ester, was employed for the preparation of 8. beta-(Benzylamino)butyric acid, required for the synthesis of 9, was prepared from benzylamine and ethyl crotonate with subsequent hydrolysis of the ester. alpha-Cyclohexyl-beta-(benzylamino)propionic acid, required for the preparation of 11, was obtained by the following series of reactions: ethyl cyclohexylcyanoacetate $\xrightarrow{H_2,\ PtO_2}$, ethyl alpha-cyclohexyl-beta-aminopropionate $\xrightarrow{C_6H_5CH_2Cl}$ ethyl alpha-cyclohexyl-beta-(benzylamino)propionate $\xrightarrow{\text{hydrolysis}}$ acid. Ethyl beta-phenyl-beta-aminopropionate was hydrogenated to ethyl beta-cyclohexyl-beta-aminopropionate which was benzylated and then hydrolysed to produce beta-cyclohexyl-beta-(benzylamino)propionic acid, which was required for the synthesis of 12.

We were able to prepare 1-benzyl-2-azetidinone, in 40% yield, by the action of sodium hydride on N-benzyl-beta-bromopropionamide. Except for the absence of the chlorine atom, this 2-azetidinone, as well as the 2-azetidinones 5 and 8-14, are cyclic analogues of the commercial anticonvulsant N-benzyl-beta-chloropropionamide (benzchlorpropamide).

In order to obtain additional 2-azetidinones for pharmacological tests, 1-methyl-4-phenyl-(52%), 1,3-dimethyl-4-phenyl-(81%), 1,4-diphenyl-(56%), 1,4-diphenyl-3-methyl-(85%) and 1,3,4-triphenyl-2-azetidinone (7%) were prepared by a Reformatsky-type reaction which consisted of the interaction of an alpha-bromo ester, an imine and zinc. These 2-azetidinones were synthesized in this manner since their preparation by the use of a beta-amino acid chloride hydrochloride was not practical.

Microfilm $2.00; Xerox $6.80. 144 pages.

THE CHEMICAL INVESTIGATION OF DIOSCOREA MACROSTACHYA.

(L. C. Card No. Mic 59-3856)

William Abood Meer, Ph.D.
The University of Connecticut, 1959

Since there is no published information on the chemical nature of Dioscorea macrostachya, a general investigation of plant constituents and a more detailed analysis of the lipoidal matter in the roots and tubers of this species were undertaken.

Qualitative tests showed the plant material to contain saponins, tannins, organic acids and phenols, unsaturated sterols and reducing sugars. The absence of alkaloids and flavonols was also indicated.

Total ash was 1.13%, while acid-insoluble ash amounted to 0.24%.

Solvent extraction of the dried, powdered plant parts yielded 0.23% lipoidal matter, which was a yellowish-brown semi-solid.

The fatty acids were separated by the lead salt-ether method and the individual saturated acids were obtained by fractional distillation of the methyl esters under reduced pressure. The individual unsaturated acids were separated by bromination and low temperature chromatography. The mixed fatty acids were found to contain 23.1% palmitic acid, 15.4% stearic acid, 47.5% oleic and 12.3% linoleic acid.

A residue, separated during extraction of the fatty acids, was identified as a sterol glycoside. Acid hydrolysis yielded "sitosterol" and a sugar which was identified as glucose by paper chromatography and preparation of its osazone.

The unsaponifiable matter, fractionated by chromatography, which comprised about 0.85% of the fat consisted of hydrocarbon, waxy material, pigments and an unsaturated sterol. The sterol, identified as β-sitosterol, was also isolated by precipitation with digitonin. The hydrocarbons obtained appeared to be unsaturated, having specific gravities of 0.8581 and 0.8888 at 25° C., refractive indices of 1.4512 and 1.4604 at 40° C., while reacting with concentrated sulfuric acid, dimethyl sulfate and bromine.

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THE SYNTHESIS OF 2-MERCAPTOCYMENE-3-CARBOXYLIC ACID.

(L. C. Card No. Mic 59-3869)

Tully Joseph John Speaker, Ph.D.
The University of Connecticut, 1959

The synthesis of 2-mercaptocymene-3-carboxylic acid is described. This new compound is of interest because it is structurally related to the well known analgesic salicylic acid. Also prepared in the course of this investigation were the new compounds, 1-S-5-isopropyl-8-methyl-thianaphthalene-4-one, 1-S-2,3-dihydro-2,3-dibromo-5-isopropyl-8-methyl-thianaphthalene-4-one, and 1-S-2,3-dihydro-2,3-dihydroxy-5-isopropyl-8-methylthianaphthalene-4-one. These compounds are of interest because they bear structural relationships to several pharmacologically active derivatives of salicylic acid.

The synthetic route may be briefly described as conversion of 2-mercaptocymene to the analogous thianaphthalene-4-one, bromination of the ethylenic linkage in the heterocyclic ring to give the dibromothianaphthalene-4-one, which upon treatment with silver carbonate gave 1-S-2,3-dihydro-2,3-dihydroxy-5-isopropyl-8-methylthianaphthalene-4-one. Treatment of this keto-diol with periodic acid and aqueous alkali gave 2-mercaptocymene-3-carboxylic acid.

Incident to the synthesis, a series of unsuccessful synthetic routes were investigated and satisfactory methods for the preparation of 2-mercaptocymene were developed.

Microfilm $2.00; Xerox $3.00. 45 pages.

CHEMISTRY, PHYSICAL

HIGH TEMPERATURE PYROLYSIS OF ACETYLENE.

(L. C. Card No. Mic 59-4326)

Carl Faust Aten, Jr., Ph.D.
Brown University, 1959

The pyrolysis of acetylene has been investigated in the temperature range 1400-2500°K. The pyrolysis was effected by passing a shock wave through a gaseous sample of either pure acetylene or an argon-acetylene mixture. The final reaction products at these temperatures are small carbon particles and hydrogen in contrast with the predominant low temperature product, cuprene, a yellow polymer $(H_2C_2)_n$. Volatile intermediate products which have been recovered from pyrolyzed samples of acetylene, previously and in this work, are diacetylene and vinylacetylene with no evidence for the formation of other simple hydrocarbons. This result has led to the suggestion that the pyrolysis of acetylene at high temperatures proceeds via polymerization to polyacetylenes and hydrogen.

It has been observed that the reaction occurs in two stages. During the first stage the reaction formed species which absorb light strongly and continuously, with the absorption beginning in the ultraviolet and spreading through the visible spectrum. Emitted light was predominantly red but continuous and occurred primarily during the second stage of the reaction. Values for the heat of reaction were found to be 0.6 ± 0.2 Kcal./mole and 10 ± 4 Kcal./mole for the first and second stages, respectively. These values were calculated from observed reflected shock velocities. The reflected shock velocities were higher than the values calculated from the observed initial shock velocities with the assumption of no reaction in the sample. The difference between the observed and ideal velocities was taken as an approximate measure of the heat of reaction. Both the spectra and heats of reaction are consistent with the interpretation that the reaction products during the first stage are polyacetylenes and that in the second stage small carbon particles were formed.

The temperature and concentration dependence of the reaction were studied by measuring the light absorption at 3900 Å under various reaction conditions. The measurements were calibrated by comparison with the light absorption for an experiment in which the total amount of acetylene that reacted was measured. The reaction was found to be approximately second order in acetylene concentration in accord with previous work. The experimental activation energy was about 39 Kcal./mole which is lower than recent low-temperature studies (45 and 50 Kcal./mole). The second order rate constant for the consumption of acetylene in the pyrolysis reaction was found to be

$$K = 4.8 \times e^{-\frac{39 \times 10^3}{RT}} \text{ liter mole}^{-1}\text{sec.}^{-1}$$

No definite conclusion is possible as to whether the reaction proceeds by a molecular mechanism or by a free radical chain reaction. The reacrion velocity at about 2000°K. was not affected by the addition of small amounts (2%) of either nitric oxide or oxygen. The experimental results are consistent with a molecular reaction mechanism.

Microfilm $2.00; Xerox $5.80. 120 pages.

THE SURFACE CATALYSIS OF THE ORTHO-PARA CONVERSION IN LIQUID HYDROGEN BY PARAMAGNETIC OXIDES ON ALUMINA.

(L. C. Card No. Mic 59-2758)

Clarence Marion Cunningham, Ph.D.
The Ohio State University, 1954

The influence of the surface concentration and of the magnetic moments of paramagnetic ions on the rate of ortho-para conversion in liquid hydrogen was investigated for several catalysts supported on alumina. This research was the first systematic study of factors affecting the surface catalysis of the ortho-para in hydrogen in the liquid phase.

In developing the rate law for the surface catalysts of the ortho-para conversion in liquid hydrogen the writer made the following assumptions:

1. The ortho-para conversion takes place only in the first adsorbed layer on the surface of the catalyst.
2. There is a preferential adsorption of ortho-hydrogen by the surface. It is assumed that all liquid hydrogen in the chamber except the first adsorbed layer is the same

ortho concentration and that the first adsorbed layer is ortho rich.

3. The conversion within the first adsorbed layer is first-order and rate determining.

From these assumptions the chemical equation,

$$H_2 \text{ (ortho)} + \text{(paramagnetic ion)} \underset{k_2}{\overset{k_1}{\rightleftharpoons}} H_2 \text{ (para)} + \text{(paramagnetic ion)}, \quad (1)$$

and the differential equation,

$$-dO_b/dt = O_s k_1 - (1-O_s)k_2 \quad (2)$$

can be written where k_1 is the forward reaction rate constant, k_2 is the reverse rate constant, O_b is the mole fraction of ortho in the body of the liquid at time t, and O_s is the mole fraction of ortho on the surface at time t.

By defining the separation coefficient as

$$s = [O_s/(1-O_s)] \,/\, [O_b/(1-O_b)] \quad (3)$$

and expressing k_2 in terms of k_1 at equilibrium, equation (2) upon integration and substitution of limits becomes:

$$[1 + (s-1)O_b^{\infty}] \ln \frac{O_b^{\infty}-O_b^{0}}{O_b^{\infty}-O_b} + (s-1)(O_b^{0}-O_b) = \frac{sk_1 t}{1-O_b^{\infty}} \quad (4)$$

where the superscripts $^{\infty}$ and ^{0} denote the concentrations at time infinity and time zero respectively. At 20.3°K O_b^{∞} is 0.002 and may be neglected. O_b^{0} for normal hydrogen is 0.75. By substituting

$x = (O_b^{0}-O_b)/(O_b^{0}-O_b^{\infty})$, the fraction converted, (5)
and $k_1 + k_2 \cong k_1/(1-O_b^{\infty}) \cong k$,

into equation (4) the over all rate equation becomes:

$$[\ln 1/(1-x)] + (s-1)(0.75)x = skt. \quad (6)$$

Experimental values for t and x were substituted into equation (6) and s and k were determined by graphical methods.

To compare the solid solution catalysts with the impregnated catalysts it was necessary to determine the amount of paramagnetic oxide on the surface. It was assumed that all the paramagnetic ions in the impregnated catalysts are on the surface. The paramagnetic oxide concentration on the surface of the solid solution catalysts was determined in the following manner:

The area covered by a molecule of Al_2O_3 can be calculated from the unit cell for γ-Al_2O_3 which is composed of 32 oxygen atoms in cubic close pack with a = 7.895 Å. By considering the surface to be composed of a plane of closely packed oxygen atoms, the area covered by a molecule of Al_2O_3 is given by the following equation:

$$A = 4(0.866)\, 3\, [a^3/(128\sqrt{2})]^{2/3} \quad (7)$$

Next it was assumed that replacing some of the aluminum ions with ferric or chromic ions does not change the area per M_2O_3 molecule and that the mole fraction of paramagnetic ions on the surface is equal to the mole fraction of paramagnetic ions in the bulk of the solid. From these considerations it follows that the moles of paramagnetic oxide on the surface, M*, can be calculated from the equation:

$$M^* = \frac{A_S \times W \times M_F}{A \times N_A} \quad (8)$$

where A_S is the surface area per gram, W is the weight of catalyst in the cell in grams, M_F is the mole fraction of paramagnetic oxide in the catalyst, A is the area per molecule, and N_A is Avogadro's number.

The experimental apparatus used in determining the rates of conversion consisted of two vertical chambers separated by a needle valve and submerged in a cryostat of liquid hydrogen. The catalyst was placed in the lower chamber and purified hydrogen was condensed in the upper chamber. At time zero the needle valve was opened and the liquid hydrogen was forced on the catalyst with one and one-third atmospheres absolute of helium. Samples were extracted on a time schedule by means of a stainless steel capillary tube extending into the liquid phase in the lower chamber. The samples were placed in the glass storage bulbs and later analyzed by the modified macrothermal-conductivity method as described by Grilly.[1]

A series of chromic oxide and ferric oxide impregnated alumina catalysts and solid solutions of chromic oxide and ferric oxide in alumina were investigated. The chromic oxide impregnated catalysts were prepared by adsorbing chromic acid from dilute solutions on acid leached γ-alumina. After washing and drying was done, the chromic acid was reduced to chromic oxide in a stream of hydrogen at 350°C. Similarly the ferric oxide impregnated catalyst was prepared by adsorbing ferrous ammonium nitrate on acid leached carrier in the absence of air. The ferrous iron was oxidized to ferric oxide in a stream of oxygen at 300°C. One chromic oxide impregnated catalyst was prepared on unleached carrier. Solid solutions were prepared by co-precipitating $Cr(OH)_3$ - $Al(OH)_3$ and $Fe(OH)_3$ - $Al(OH)_3$ from dilute solutions of these cations with dilute ammonium hydroxide. The precipitates were washed free of nitrate, dried and heated to 400°C for one hour in air.

Adsorption isotherms up to a pressure of one atmosphere were determined for these catalysts using hydrogen at liquid hydrogen temperature and nitrogen at liquid nitrogen temperature. Surface areas were calculated by the B.E.T. method.

A summary of all experimental data is given in Table I and Figs. 1 and 2. The hydrogen surface areas are given in column 5 and the nitrogen surface areas in column 6. Column 7 gives the total number of moles of paramagnetic oxide in the reaction chamber. The number of moles of paramagnetic substance on the surface, column 8, was calculated in the case of the solid solutions by equation (8). A plot of moles (column 7) vs k/μ^2 (Fig. 1) for the three chromia catalysts on leached carrier gives a straight line, but this line does not pass through the origin. For these three catalysts the intercept of this line with the y axis is subtracted from column 7, and the difference is given in column 8. Column 9 gives the experimentally determined

Table I

Summary of Rate Data

1	2	3	4	5	6	7	8	9	10	11
Catalyst	Weight of Catalyst grams	Weight Per Cent of Paramagnetic substance	Mol Per Cent of Paramagnetic substance	H_2 Surface Area $m^2/g.$	N_2 Surface Area $m^2/g.$	Moles of Paramagnetic substance M	Moles of Paramagnetic substance on surface $M^* \times 10^6$	k $Min.^{-1}$	$k/\mu^2 \times 10^6$ $Min.^{-1}$	$k/\mu^2 M$ $Min.^{-1}$ $Mole^{-1}$
Leached carrier	27.68	0.016	0.010	142	87.2‡	2.6×10^{-6}	0.32	0.000586	0.167	5.6
19 Cr	27.63	0.0486	0.0326		87.2‡	8.91×10^{-6}	4.71†	0.00466	2.70	5.7†
21 Cr	27.85	0.237	0.159		87.2‡	43.5×10^{-6}	39.3†	0.0343	22.3	5.7†
25 Cr††	28.03	0.286	0.192		99.3§	52.6×10^{-6}		0.0468	31.0	5.9
20 Cr	28.01	0.627	0.420	138	87.2‡	115×10^{-6}	111†	0.099	66.0	5.9†
2 Fe	28.03	0.238	0.152		87.2‡	41.7×10^{-6}		0.056	16.0	3.84
2 Fe*	27.95	0.238	0.152		87.3‡	41.6×10^{-6}		0.0095	2.72	0.65
Fe_2O_3(25)	10.16		5.22	482		0.531	209	0.105	30.0	1.44
Fe_2O_3(10)	10.64		2.15	535		0.229	99	0.574	16.4	1.67
Cr_2O_3(25)	11.22		5.96	511		0.668	279	0.0564	37.3	1.32
Cr_2O_3(10)	9.32		2.47	560		0.230	105	0.0206	13.6	1.29
Al_2O_3Blank	13.48			518	327			0.000478		

††On unleached carrier
*Heated for 16 hours at 600° C after impregnation
‡Average of several determinations by Chapin[3]
§Determined on the unimpregnated unleached carrier
†Corrected for diffusion

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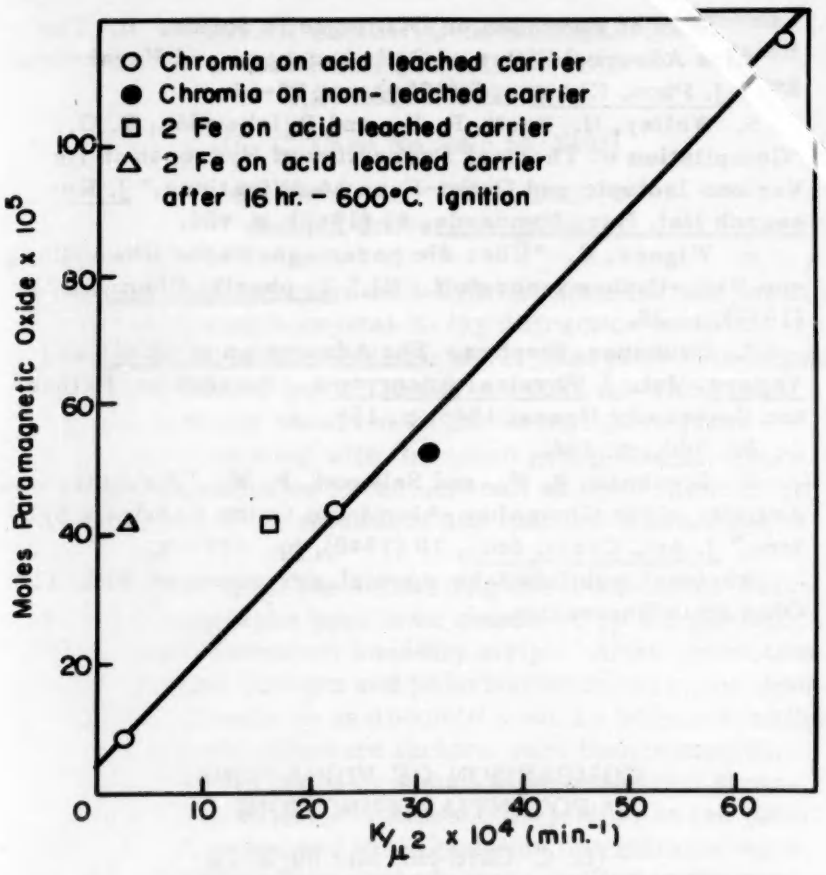


FIG. 1. Ortho-para Conversion Rate per Unit Magnetic Moment vs. Moles of Paramagnetic Oxide on Impregnated Aluminas.

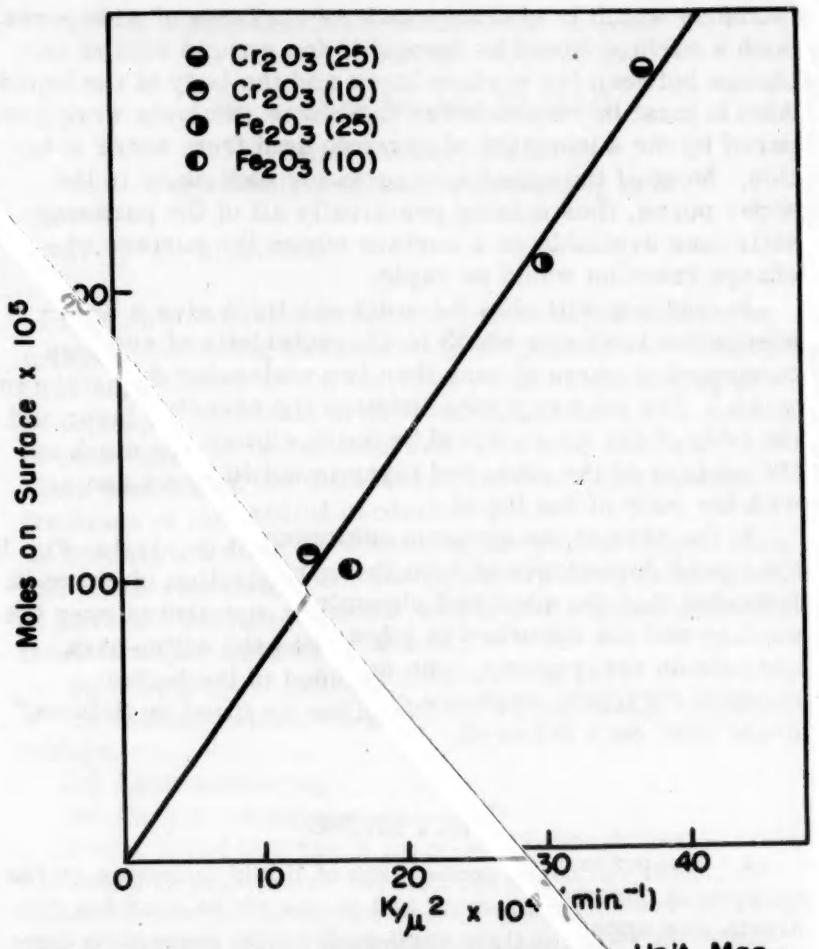


FIG. 2. Ortho-para Conversion Rate per Unit Magnetic Moment vs. Moles Paramagnetic Oxide on Surface of Solid Solution Catalysts.

first-order rate constants. In column 10, k is divided by the square of the effective magnetic moment for the various ions. The values $\mu(Cr^{+3}) = 3.87$ and $\mu(Fe^{+3}) = 5.92$ Bohr magnetons used in this work are those given by Van Vleck.[2] The results given in column 11 were obtained by dividing column 10 by column 8 where values are given in column 8 or by dividing column 10 by column 7 where no values are given in column 8.

The rate data was fitted to equation (6) very satisfactorily. From the six runs in which the rate data were complete enough to calculate a value for s, the average value was found to be $16 \neq 3$. The average value for s was used in calculating k. An error of ± 5 in s causes less than 5 per cent error in the determination of the first-order rate constant. Sandler[4] suggested that the preferential adsorption of ortho-hydrogen on a surface was due to hindered rotation. By assuming the molecules of hydrogen are restricted to rotation in a plane, he gives the separation coefficient

$$s = 2/3 \exp(\epsilon_1/2kT), \qquad (9)$$

where $\epsilon_1 = 338$ cal./mole, the molar heat of conversion of ortho- to para-hydrogen. This equation was developed for a gas system; however it might be applied to the liquid system by correcting ϵ_1 for the difference between the heats of vaporization of ortho and para-hydrogen. An equation for calculating the heats of vaporization of ortho-para mixtures was given by Wolley, Scott and Brickwedde.[5] From their equation it was calculated that the heat of vaporization for ortho-hydrogen is 4.3 cal./mole higher than that for para-hydrogen. Thus for the liquid ortho-para conversion ϵ_1 was taken to be 334 cal./mole. Substituting this value into equation (9) it was found at 20.3°K that s = 41. If these assumptions are valid, apparently the first adsorbed layer is not entirely restricted to a plane rotator.

Wigner[6] has obtained an equation for the overall collision efficiency of the homogeneous para-ortho conversion induced by para-magnetic molecules. This equation, which cannot be applied directly to the present work, suggests that the rate of conversion is proportional to the square of the magnetic moment of the perturbing molecule. An examination of column 11, Table 1 and Fig. 2 will show that this is approximately true in the case of the solid solutions.

However, in the case of the impregnated catalyst it must be noted that the 2 Fe catalysts had a much lower rate than was expected (Table I and Fig. 1). A portion of this catalyst was heated for 16 hours at 600°C and the rate again determined. The rate decreased to approximately one-fifth its original value. These experiments suggested that the ferric oxide diffused into the solid carrier. Although the surface area has not been determined for this particular catalyst, it is believed that this decrease in rate could not possibly be due to a change in surface area. Measurements on other catalysts have shown that this treatment at most changes the surface area less than 10 per cent. Further evidence for diffusion is offered by the fact that the rate vs. concentration curve for the leached chromia catalysts (Fig. 1) does not pass through the origin. Apparently chromic oxide diffuses into alumina but not as rapidly as ferric oxide. The rapid diffusion of the ferric oxide probably results from the fact that γ-Fe_2O_3 and γ-Al_2O_3 have identical crystal structures.

The value for k/μ^2 per mole (column 11, Table I) for the solid solutions was approximately one-fourth that for the impregnated catalysts. This is believed to be due to a difference in diffusion rates to and from the catalytic surfaces.

The impregnated carriers give a Type II adsorption

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isotherm which is characteristic of surfaces of wide pores.[7] Such a surface would be favorable for a rapid rate of exchange between the surface layer and the body of the liquid. Also it must be remembered that these catalysts were prepared by the adsorption of chromic acid from water solution. Most of the adsorption probably took place in the wider pores, thus making practically all of the paramagnetic ions available on a surface where the surface exchange reaction would be rapid.

In contrast with this the solid solutions give a Type I adsorption isotherm which is characteristic of surfaces composed of pores of less than two molecular diameters in width.[8] The exchange rate between the adsorbed layer and the body of the liquid would be much slower, for much of the surface of the adsorbed layer is not in direct contact with the body of the liquid.

In the case of the chromia impregnated catalysts, Fig. 1, the linear dependence of k on the concentration of chromia indicates that the adsorbed chromia is distributed over the surface and not adsorbed in piles. Had the ortho-para conversion experiments been extended to the higher chromia catalysts, evidence of piling as found by Selwood[9] might have been detected.

CONCLUSIONS

1. The ortho-para conversion of liquid hydrogen on the surface of chromia-alumina and ferric oxide-alumina catalysts was approximately zero-order with respect to concentration of ortho-hydrogen below 70 per cent completion and approached first-order above 70 per cent completion.

2. The experimental results were explained by assuming: (a) that the reaction took place only within the first adsorbed layer, (b) that there was preferential adsorption of ortho-hydrogen on the surface of the catalyst, and (c) that the reaction rate was first-order with respect to the ortho concentration in the first adsorbed layer.

3. The first-order rate constant increased linearly with the concentration of chromic oxide on the chromic oxide impregnated catalysts.

4. The first-order rate constant increased linearly with the concentration of paramagnetic oxide in solid solution Fe_2O_3-Al_2O_3 and Cr_2O_3-Al_2O_3 and as the square of the magnetic moment of the paramagnetic ion.

5. The observed first-order rates for the impregnated catalyst and the solid solutions were brought into qualitative agreement by considering the differences in their adsorption isotherms.

6. The large separation coefficient combined with the very small rate of conversion found for the alumina carrier suggests that this substance could be used at liquid hydrogen temperature to prepare pure ortho-hydrogen.

Microfilm $2.00; Xerox $4.60. 89 pages.

1. [G]rilly, E. R. "A Simple Thermal Conductivity Analyzer for [O]rtho-Para Hydrogen," Rev. Sci. Instruments, 24 (1953), pp. [7]2-3.

2. Van Vleck, J. H. The Theory of Electric and Magnetic Susceptibilities. Oxford: Clarendon Press, 1932, p. 285.

3. Chapin, D. S. "[T]he Surface Catalysis of the Ortho to Para Conversion in [H]ydrogen Under Pressure at Liquid Nitrogen Temperature." [D]octoral dissertation: The Ohio State University, 1954, p. 41.

4. Sandler, Y. L. "The Adsor[p]tion and Ortho-Para Conversion of Hydrogen on Diamagnetic Solids. II. The Relative Adsorbabilities of Orthohydrogen and Parahydrogen," J. Phys. Chem., 58 (1954), pp. 58-61.

5. Wolley, H., Scott, R. B., and Brickwedde, F. G. "Compilation of Thermal Properties of Hydrogen in its Various Isotopic and Ortho-Para Modifications," J. Research Nat. Bur. Standards, 41 (1948), p. 466.

6. Wigner, E. "Über die paramagnetische Unwandlung von Para-Orthowasserstoff. III," Z. physik. Chem., B23 (1933), p. 28.

7. Brunauer, Stephen. The Adsorption of Gases and Vapors, Vol. I, Physical Adsorption. Princeton: Princeton University Press, 1945, p. [1]55.

8. Ibid., p. 166.

9. Eischens, R. P., and Selwood, P. W. "Structure and Activity of the Chromium-Aluminum Oxide Catalysts System," J. Am. Chem. Soc., 70 (1948), pp. 2271-3.

Abstract published by special arrangement with The Ohio State University.

COMPARISON OF VIBRATIONAL POTENTIAL FUNCTIONS.

(L. C. Card No. Mic 59-3741)

Earl C. Curtis, Jr., Ph.D.
University of Minnesota, 1959

The theory of the method of least squares was rewritten in terms of the adjustment of force constants to fit the vibrational frequencies of molecules. It was found possible to estimate the uncertainties in the observed frequencies and the calculated frequencies and force constants.

As a test of the methods, the force constants were determined for ethylene using three potential functions and several degrees of approximation. The F test was used to compare the results. Since six deuterated ethylene derivatives were used in addition to ordinary ethylene it may be expected that the results are much more certain than is usually possible.

The calculations were carried out with an 1103 UNIVAC digital computer. Because of the large amount of data that was used it was necessary to devise programs so nearly all the work could be done in the computer.

From the criterion that a good force field should reproduce the observed frequencies with a minimum number of adjustable parameters it was shown that the valence force field and the Urey-Bradley force field modified with a "flexible bond" term were equally good. The central force field and the Urey-Bradley force field without the flexible bond term were found to be "bad" force fields.

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CRYSTAL STRUCTURE STUDIES OF 8-HYDROXYQUINOLINE AND 2,2'-BIQUINOLINE.

(L. C. Card No. Mic 59-3997)

Sankar Kumar Datta, Ph.D.
Indiana University, 1959

The crystal structure of 8-hydroxyquinoline has been studied using single crystal X-ray diffraction methods. X-ray diffraction data indicate the crystal to be orthorhombic, with a = 29.52 b = 25.22 and c = 3.85 Å. The systematic extinctions observed on the Weissenberg photographs are consistent with the space group Fdd 2. There are sixteen molecules in the unit cell as determined from a comparison of the measured and calculated densities of the crystal.

Intensities of all the reflections observed on the Weissenberg photographs have been measured by comparison with specially prepared intensity strips. After correction for generalized Lorentz and polarization factors, the intensities were brought to an absolute scale by Wilson's method and the observed structure factors were then computed.

Attempts were made to deduce a possible trial structure in several ways. A Patterson projection on the (001) plane was computed and three possible orientations were derived. Superposition methods were applied to the projection in the search for a trial structure. After this a complete three-dimensional Patterson function was computed and both superposition and "trial and error" methods were used in order to solve the crystal structure of this compound. Lastly, attempts were made to establish definite sign relations between different structure factors using Harker-Kasper inequalities and equalities of the form established by Sayre and Cochran.

The three-dimensional crystal structure of 2,2'-biquinoline has been determined, initially by using the intensity data of earlier workers and finally by using completely new data. The earlier data were used to obtain improved atomic positions by means of two successive three-dimensional Fourier electron-density syntheses. Because of the limited number of intensity data, new Weissenberg photographs using longer X-ray exposure times were obtained. After measurement and correction of intensities, the observed structure factors were computed and were used to further refine the structure by a third three-dimensional Fourier. Finally, the structure was refined by seven cycles of least-squares refinement. Assumed hydrogen atom positions were included in the calculations after the third stage of least-squares refinement. Separate isotopic temperature factor exponents, "B"'s, were used for each atom. The final value of the "reliability index," R, is 15.3%.

The molecule is with the two nitrogens atoms in trans positions planar in the crystalline state. The type of packing is somewhat similar to those in naphthalene and anthracene. There are no unusually close approaches between atoms of neighbouring molecules in the crystal. The length of the central bond is comparable to the length of the corresponding bond in similar molecules and is consistent with the assumption that this bond has only a little double bond character. None of the other bonds in either of the quinoline rings are very unusual in length, and are in accordance with the expected deviations from an ideal naphthalene structure due to the presence of the hetero nitrogen atom.

Microfilm $2.00; Xerox $4.20. 76 pages.

A COMPARATIVE STUDY OF K AND λ CARRAGEENAN IN SOLUTION.

(L. C. Card No. Mic 59-3624)

Elliott Farber, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: F. R. Eirich

Carrageenan, an extract from Irish moss (Chondrus crispus) consisting basically of a polygalactose sulfate, has been subjected to an extensive physical-chemical analysis in solution. Its behavior as a polyelectrolyte was studied in these measurements in order to be able to draw conclusions concerning the differences between the two main fractions of the natural product.

The Na^+, K^+ and Ca^{++} salts of the parent preparation and of the two main fractions (K and λ) were investigated at different polymer concentrations and varying concentrations of added salts by means of:

(a) Viscosity at different rates of shear.

(b) Sedimentation velocities in the analytical ultracentrifuge.

(c) Light scattering.

(d) Flow birefringence.

It was found that the K fraction has the larger intrinsic viscosity in pure water but that the λ has the larger reduced viscosities at higher salt or polymer concentrations. The K fraction shows shear dependence of the intrinsic viscosities while the λ fraction shows a larger shear dependence for the viscosity slope constant. There is little influence of H-bond breaking additives so that at high dilutions, i.e., below 0.10%, both fractions seem to be molecularly dispersed. This follows also from the course of the intrinsic viscosities on adding extraneous electrolyte where a critical concentration of the latter causes a sharply defined onset of aggregation. In the high dilutions investigated, this critical electrolyte concentration for the K fraction is independent of polymer concentration but is a sensitive function for the nature of the counterion. The lowest threshold value is found for K^+. λ carrageenan does not show any aggregation at any salt concentration in the range of concentrations and temperatures observed.

Corresponding observations were made by the sedimentation method where, again, the same critical salt concentrations necessary for aggregation (as determined from the viscosity experiments) of the K fraction were found.

In light scattering, these aggregation regions are not experimentally accessible because of accompanying difficulties of filtration and coarse turbidities.

The birefringence data, finally, also could not be carried to sufficient dilutions to arrive at conclusions of the behavior of individual molecules but a sharp change in the magnitude of birefringence at the critical salt concentrations indicated aggregation.

Analyzing these findings, one can arrive at the following conclusions:

(a) K carrageenan, in this particular case, is of lower molecular weight than the λ fraction but has the higher axis ratio in pure water and the greater flexibility.

(b) The λ fraction has the higher solubility, the more extended counterion cloud and, very likely, is branched. These conclusions are tentative as they depend on the molecular models assumed for the calculations. It appears that the coiled model is more applicable to the λ than to the K fraction.

(c) Both K and λ chains are very much stiffer than vinyl-type polymers and comparable in their solution parameters with cellulose derivatives.

Microfilm $2.20; Xerox $7.80. 166 pages.

VALENCE STATE ENERGIES OF CARBON AND IRON AND THE CARBON-IRON BOND ENERGY.

(L. C. Card No. Mic 59-3419)

Ivan Joel Goldfarb, Ph.D.
University of Cincinnati, 1959

Valence state promotion energies and valence state ionization potentials of carbon and iron have been calculated as a function of the hybridization on the atom. The values have been used in the approximate calculation of an iron-carbon bond energy as well as for the evaluation of electronegativities of the atoms under consideration.

The valence state energies were evaluated from equations derived in terms of Slater atomic spectral parameters. These parameters were obtained by "least squares" fitting of atomic energy equations in terms of these parameters to the observed spectroscopic energy levels. Both the derivation of the atomic energy equations and the "least squares" fit were accomplished on an IBM 650 digital computer.

Of particular interest was the valence state ionization potential of hybrid electrons which requires the removal of an electron from a hybridized orbital. This involved calculation of valence state promotion energies of ions with non-integral numbers of s, p and d electrons.

The carbon-iron bond energy was approximated by the use of Mulliken's "Magic Formula" wherein only those terms pertaining to the individual bond are retained. This formula involves, in addition to valence state promotion energies and ionization potentials, overlap integrals which were therefore obtained from previous tabulations.

The valence state promotion energy, ionization potentials and electronegativities of carbon as a function of hybridization are as follows:

Hybridization	Promotion Energy	Ionization Potential	Electronegativity
tetrahedral	6.73 eV	14.43 eV	2.71
trigonal (σ)	6.93 eV	15.40 eV	2.98
trigonal (π)	- - -	11.16 eV	1.84
digonal (σ)	7.31 eV	17.31 eV	3.51
digonal (π)	- - -	11.09 eV	1.83

where (σ) and (π) refer to the hybrid σ orbital and the unhybridized $p\pi$ orbital, respectively, and the electronegativities are listed on the Pauling scale of electronegativities.

A similar set of promotion energies and ionization potentials were obtained for iron; however, paramagnetic divalent and trivalent valence states as well as diamagnetic tetravalent states were considered. The valence states of d^6s^2 had both the lowest promotion energies and the highest ionization potentials, with the divalent state having a promotion energy of 1.90 eV and an ionization potential of 14.12 eV.

When the bond energy between tetrahedral carbon and iron had been approximated, only the d^6sp, divalent state of iron yielded a high enough bond energy (~ 35 kcal) to account for a stable iron-carbon bond. This is interesting in view of the fact that $FeCl_2$ probably uses d^6sp hybridization on iron. Change in hybridization of the carbon from tetrahedral to trigonal appeared to increase the bond energy by about 1 eV, while the digonally hybridized carbon further stabilized the bond by 1/2 eV. Thus it would be expected that an acetylide of iron may be stable.

Microfilm $2.15; Xerox $7.60. 161 pages.

THERMODYNAMIC PROPERTIES OF DILUTE AQUEOUS HYDROCHLORIC ACID SOLUTIONS AT ELEVATED TEMPERATURES FROM ELECTROMOTIVE FORCE MEASUREMENTS.

(L. C. Card No. Mic 59-4256)

Richard Stiles Greeley, Ph.D.
The University of Tennessee, 1959

Major Professor: W. T. Smith, Jr.

The electromotive force of the cell

Pt; $H_2(g)$, HCl(m), AgCl; Ag

was measured at temperatures from 25 to 200° C. and in some cases to 275° C. using hydrochloric acid concentrations from 0.005 to 1.0 m and hydrogen pressures of about one atmosphere. A closed, static, high pressure system was used which consisted of a fused silica vessel contained tightly in a steel autoclave with a Teflon interliner.

The measurements were reproducible to within ±0.5 mv. from 25 to 225° C., ±2 mv. at 250° C., and ±5 mv. at 275° C. At 25 to 90° C. the results agreed satisfactorily with previous investigations.

Calculations were made of the standard potential of the silver-silver chloride electrode; and the mean ionic activity coefficient, the relative partial molal heat content, the relative partial molal heat capacity, and the pH of hydrochloric acid. The standard electrode potential was expressed by the following equation:

$$E^0 = 0.23735 - 5.3783 \times 10^{-4}t - 2.3728 \times 10^{-6}t^2 \text{ volts}$$

with a standard error of fit of 0.19 mv. from 25 to 200° C. The Debye-Hückel extended equation was used satisfactorily to express the mean ionic activity coefficients, although the ion-size parameter appeared to be simply an adjustable parameter. Microfilm $2.00; Xerox $6.60. 139 pages.

DIELECTRIC DISPERSION IN VISCOUS LIQUID MEDIA.

(L. C. Card No. Mic 59-3423)

Moshe Ish-Shalom, Ph.D.
University of Cincinnati, 1959

An experimental study was made of the dielectric properties of solutions of nitrobenzene in two different types of viscous solvents of low polarity over the range of frequencies of 50c/s to 100c/s, over a wide range of temperatures and low concentrations of the polar solute. One solvent was a mixture of Ortho- and Para- terphenyls with Triphenylmethane, in which some nitrobenzene could be dissolved, and which could be supercooled to the temperatures of interest. The other solvent was a butylene polymer of low molecular weight. (~800). The range of temperatures included the region of anomalous dispersion.

The object was to see how the behavior of a simple highly polar molecule, whose behavior in the pure liquid state and in solution in simple low viscosity solvents is known, will be modified by dissolving it in a highly viscous solvent. The two solvents were chosen to represent different types of environments.

The main results are that the highly viscous environment did indeed modify the simple Debye type behavior of the solute, yielding a highly skewed Cole-Cole plot. The variation of the frequency of maximum absorption with temperature was used to estimate the free energy and entropy of activation of the dielectric relaxation. The entropy of activation is very high and there is a pronounced difference in its value between the two types of solutions: it is about 180 e.u. in the solvent mixture of Terphenyls and about 70 e.u. in the polymer solutions.

The skewed behavior is of particular interest since it is also shown in other cases reported in the literature on supercooled liquids on the one hand and of some polymeric systems on the other hand. It seems that the Davidson-Cole Equation for the skewed arc fitted the data somewhat better at higher values of β than at lower ones.

The cause for this behavior is not yet understood. The variety of systems that show this type of behavior seems to exclude any chemical specificity as its cause. The possibility that a highly skewed distribution of times of relaxation can be the cause for these results has been proposed and discarded earlier by Davidson and Cole. In the discussion an argument is presented to reinstate such a possibility as a plausible one.

Microfilm $2.00; Xerox $5.60. 114 pages.

PREPARATION AND PROPERTIES OF ION-EXCHANGE INTERPOLYMER MEMBRANES.

(L. C. Card No. Mic 59-3629)

Harold Jacobson, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: Harry P. Gregor

The objective of this study was the development of ion-selective membranes and the study of their physical and electrochemical properties.

Interpolymer ion-selective membranes were prepared by casting films from solutions of linear polystyrenesulfonic acid (PSA) and Dynel (DYN) and allowing the solvent to evaporate. Suitable solvents were either N,N-dimethylformamide (DMF) or dimethylsulfoxide (DSO). The resulting membranes consist of a polyelectrolyte insolubilized by entanglement with a matrix material. The former contains dissociable groups which ionize and create hydrophilic passages through which diffusing species migrate.

Extensive characterization studies made upon the resulting membranes included the determination of concentration potentials, bi-ionic potentials, ohmic resistances, osmotic flow rates, exchange capacities, thicknesses, water contents, and permeabilities to non-electrolytes and electrolytes.

Membranes containing 25% PSA had concentration potentials of 15.2 to 15.8 mv. as compared to a theoretical maximum of 16.11 mv. for 0.2 M versus 0.1 M potassium chloride. The ohmic resistances ranged from about 250 ohm-cm.^{2} for a thickness of about 38 microns to about 10 ohm-cm.^{2} for a thickness of about 10 microns. Increasing or decreasing the PSA content resulted in lower concentration potentials. The former also resulted in lower ohmic resistances. Unsuccessful attempts were made to preserve the lower ohmic resistances in combination with high concentration potentials by inducing cross-linking with radiation and chemical reagents.

Water permeability was of the order of 10^{-3} ml./cm.^{2}hr. for an osmotic gradient of approximately 24 atmospheres and is thus seen to be quite low. Nevertheless, it was possible to separate water from salt because of the operation of the Donnan equilibrium which made for a very low concentration of the latter within the membrane phase. The denseness of the membrane structure was emphasized by the fact that the membranes were impermeable to materials only slightly larger than raffinose.

The equivalent conductances of two commercial cation-exchange membranes in the following ionic states were determined: hydrogen, ammonium, potassium, sodium, lithium, tetramethylammonium, tetraethylammonium, tetra-n-propylammonium, and tetra-n-butylammonium. For those ions other than the quaternary ammonium ions, it was found that the equivalent conductances of the membranes were directly proportional to the equivalent conductances of the respective ions in aqueous solution. This proportionality did not exist for the organic ions from which it was concluded that these ions were sterically hindered.

Pore sizes were estimated by calculating self-diffusion coefficients within the membrane from the equivalent conductance data. Three factors were considered as contributing to the markedly lower membrane diffusion coefficients, viz., the true membrane area available for diffusion, the tortuous paths available in the membrane, and the Faxen drag factor which was originally applied as a correction to Stokes' equation to take into account the influence of the proximity of walls upon the motion of a body in a fluid. The Faxen factor relates the pore radius to the radius of the permeating species. From a knowledge of the latter, the former was obtained and was found to be approximately 5 angstroms for a commercial membrane designed as Nalfilm 1 and 8 angstroms for another more porous membrane designated as Nalfilm 3.

Microfilm $2.30; Xerox $8.00. 173 pages.

PART I. THE APPLICATION OF A STRAIN POTENTIAL FUNCTION TO PLANAR X_2Y_4 MOLECULES.
PART II. THE THERMAL DECOMPOSITION OF ETHYL CHLOROFORMATE.

(L. C. Card No. Mic 59-3846)

Emmett Francis LaPointe, Ph.D.
The University of Connecticut, 1959

PART I

A normal coordinate analysis was carried out for the in plane vibrations of X_2Y_4 molecules possessing D_{2h} symmetry This analysis was based on a strain type potential function of the general form:

$$2V = \underset{\text{all bonds}}{\Sigma} k_{il}(L_{il}-\lambda_{ilo})^2 + \underset{\text{all non-bonds}}{\Sigma} k'_{il}(L'_{il}-\lambda'_{ilo})^2 + \underset{\text{all bond angles}}{\Sigma} k_j(\alpha_j-A_{jo})^2,$$

where k_{il}, k'_{il} and k_j are the restoring force constants for the bond stretchings, non-bond stretchings and angle bendings; L_{il}, L'_{il} and α_j are the instantaneous values of the interatomic distances and bond angles; λ_{ilo}, λ'_{ilo} and A_{jo} are the values of the interatomic distances and bond angles in the strain-free state.

The Lagragian method is used to develop the secular equations for the symmetry classes considered. Values were obtained for the X-X and X-Y stretching force constants and for the X-Y-X and X-Y-Y angle bending constants. Other parameters peculiar to this type of potential function were evaluated. These parameters involved strain-free terms and are of theoretical interest. Numerical values of all the considered parameters were calculated for the molecules C_2H_4, C_2D_4, C_2F_4, C_2Cl_4 and N_2O_4.

PART II

The thermal decomposition of ethyl chloroformate in the gaseous state was studied at low pressures over a temperature range from 180°-210°C.

The course of the decomposition of the ethyl chloroformate was followed by periodically scanning the infra red absorption spectrum of the sample being decomposed.

The products of the decomposition were shown, by analysis of the spectra, to be ethylene, carbon dioxide and a very small amount of ethyl chloride. The presence or absence of HCl in the gas phase could not be demonstrated by this method.

The reaction was shown to be heterogeneous and inhibited by acid treatment of the cell walls.

Analysis of the time dependence of the intensities of absorption bands of both reactants and products indicates that the reaction is first order throughout it's course.

The rate constants for the reaction were evaluated from the log optical density versus time graphs and were found to vary from 10^{-4} to 10^{-3} at about 190°C. The observed variation depended upon the past history of the cell. A series of runs on a cell whose surface remained approximately constant allowed the evaluation of the energy of activation for the heterogeneous reaction. This energy of activation was found to be of the order of 19 kilocalories per mol.

The heterogeneity of the reaction and the inactivation of the cell surface by acid indicates a mechanism involving a reaction between a hydrogen atom of the ethyl group and a Lewis base site on the wall of the cell to give a trans type elimination.

Microfilm $2.00; Xerox $6.40. 133 pages.

SURFACE TENSIONS OF THE MOLTEN SALT SYSTEMS CALCIUM CHLORIDE-POTASSIUM CHLORIDE AND CALCIUM CHLORIDE-CESIUM CHLORIDE.

(L. C. Card No. Mic 59-4016)

Duane Stanley Lehman, Ph.D.
Indiana University, 1959

A new modification of the maximum bubble pressure method for measuring surface tensions of fused salts was introduced and applied in measuring the surface tensions of the molten salt systems calcium chloride-potassium chloride and calcium chloride-cesium chloride over their entire ranges of composition.

The new modification involved the utilization of the linear relation of total maximum bubble pressure to the depth of immersion of the capillary tip as shown by the equation

$$\Delta P = mz + \bar{p}$$

where ΔP is the total maximum bubble pressure, z is the depth of immersion of the capillary tip, $\bar{p}$ is the pressure due to surface tension only, and the slope, m, is a function of the density of the melt. By measuring the total maximum bubble pressure at several carefully measured depths of tip immersion, data were obtained which permitted the calculation of the density of the melt and the pressure due to the surface tension of the melt.

The linear equations relating surface tension to temperature over the temperature range studied were evaluated at a number of compositions for both salt systems. The constants for the equation

$$\gamma_t = kt + \gamma_o$$

where γ is the surface tension at temperature t and k is the temperature coefficient of surface tension over the temperature range studied, are as follows:

Calcium Chloride-Potassium Chloride System

Mole % KCl	-k dynes/cm. per °C.	γ_o dynes/cm.	Temp. Range, °C.
100.0	.0760	159.5	828-918
91.7	.0699	156.6	795-909
80.6	.0604	150.5	800-906
73.4	.0733	164.2	803-906
62.8	.0689	164.4	789-920
51.5	.0686	167.6	800-908
44.9	.0577	161.4	798-919
29.3	.0518	164.8	793-908
21.0	.0454	164.0	801-911
10.9	.0390	166.4	803-910
0.0	.0272	170.7	796-914

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Calcium Chloride-Cesium Chloride System

Mole % CsCl	-k dynes/cm. per °C.	γ_o dynes/cm.	Temp. Range, °C.
100.0	.0610	127.0	762-883
87.8	.0701	139.0	764-862
75.0	.0913	159.9	837-902
58.8	.0960	173.2	992-1065
38.4	.0688	157.0	1014-1054
29.2	.0567	151.3	974-1046
19.3	.0551	158.6	907-1024
13.1	.0424	153.8	796-949
0.0	.0272	170.7	796-914

Surface tension versus composition isotherms were calculated and, for the calcium chloride-potassium chloride system, were compared with an ideal surface tension for perfect solutions. Both of the molten salt systems showed large negative deviations from ideality, with the calcium chloride-cesium chloride system exhibiting the greater deviation. These deviations are indicative of the strong inter-ionic forces present in the molten state of these salt mixtures.

Microfilm $2.00; Xerox $4.80. 93 pages.

STUDIES OF GAS ADSORPTION WITH A FIELD EMISSION MICROSCOPE.

(L. C. Card No. Mic 59-4234)

Gordon Littlepage Link, Ph.D.
University of Virginia, 1959

The field emission microscope has been used to make adsorption studies. The method used was to measure field emission current as a function of time while the tip was being covered with adsorbed gas. The measurements were made at constant tip temperature and with a constant applied voltage. The measurements so obtained were converted to coverage versus time data by assuming a linear relation between coverage and field emission current. The coverage data were then used to test various proposals about the nature of the adsorption process.

The discussion which was presented indicated that when ethyl sebacate was admitted to the field emission microscope, evidence could be found for two types of adsorption occurring, a strong type and a weak type. Details of the adsorption process were discussed in terms of the experimental observations and it was concluded that the proposed method needed further work on the determination of the relation between coverage by adsorption and work function.

Microfilm $2.00; Xerox $4.20. 79 pages.

THERMODYNAMIC PROPERTIES OF NONSTOICHIOMETRIC NICKEL TELLURIDES AND OF TELLURIUM.

(L. C. Card No. Mic 59-3938)

Robert Engel Machol, Ph.D.
University of Michigan, 1958

The system nickel/tellurium is of interest because of the continuous and homogeneous transition between NiTe and $NiTe_2$, which have different crystal structures. As part of a thermodynamic study of these compounds, an attempt was made to gather data which would determine zero-point entropies as a function of composition. Part of the necessary data have been gathered, and in addition a number of other pertinent or interesting properties of the nickel tellurides, and of tellurium, have been investigated.

Specific heats from 4° to 350° K have been measured on $NiTe_{1.1}$, $NiTe_{1.5}$, and $NiTe_{2.0}$, and the thermodynamic functions of these and all intermediate compositions may be considered accurately known over this temperature range. The method employed was conventional precise adiabatic calorimetry in an existing apparatus.

The melting point of tellurium has been redetermined and the highly discordant literature critically reexamined; the triple point may now be stated with some confidence to be 449.7° ± 0.2°C.

The dissociation pressures of compositions from $NiTe_{1.5}$ to $NiTe_{2.0}$ have been accurately measured at temperatures up to 780°C in order to determine the partial molal free energies and entropies of tellurium in these compounds. These measurements have incidentally elucidated the phase behaviour in the tellurium-rich region, showing a high solubility of nickel in liquid tellurium at elevated temperatures, and incongruent melting of the solid solutions such that tellurium-rich solid solutions are unstable at elevated temperatures.

To obtain these measurements, an old method of measuring vapor pressures at high temperatures--namely the use of a silica bourdon gage--has been modified and improved, so that it is capable of very high accuracy (0.1 mm Hg and 0.1°C) over a wide range of conditions and up to at least 855°C and probably much higher. Improvements consisted of methods of effectively outgassing the apparatus, of purifying the sample, of making the pointers visible so that accuracy and consistency of pressure measurements were possible, and of ensuring homogeneity and accuracy of measurement of sample temperature.

The vapor pressure of tellurium was measured originally to check out the apparatus. The final results were more accurate than those of previous investigators, and sufficiently precise to require the use of a four-parameter equation. The results are represented by

$$\log P = -10{,}663.14/T + 64.73140 - 18.61687 \log T + 0.00341783\ T$$

where P is in mm Hg and T is in degrees Kelvin. Theoretical study of the data has indicated that deviations from ideality of tellurium vapor appear at a much lower pressure than one would predict from the behaviour of more familiar gases. Since this cannot be due to molecular dissociation, it must mean that the van der Waals' constants (or second and higher virial coefficients) are unusually high. By extrapolation, the boiling point of tellurium is

computed to be 993.6 ± 2°C, and the heat of vaporization to be 33,850 - 908 t cal/mole (one mole equals two gram-atoms), with an accuracy of plus or minus several hundred calories, from the triple point to t = 850°, or perhaps 950°C. This figure may be considered more accurate, though stated with less precision, than those of previous investigators. Microfilm $2.00; Xerox $6.60. 137 pages.

THE KINETICS AND MECHANISM OF THE REACTION OF SOME BIS-ORGANOMERCURY COMPOUNDS WITH HYDROCHLORIC ACID.

(L. C. Card No. Mic 59-3425)

Garth Fredric Reynolds, Ph.D.
University of Cincinnati, 1959

Previous investigations of the acid cleavage of bis-organomercury compounds

$$R\text{-}Hg\text{-}R + HCl \longrightarrow R\text{-}H + R\text{-}Hg\text{-}Cl$$

have dealt almost exclusively with diarylmercury compounds which in general are cleaved about 10^3 times more rapidly than the saturated dialkylmercury compounds. Ordinarily these reactions are carried out in aqueous alcohols or aqueous dioxane; however, the cleavage of the dialkylmercury compounds in these solvent systems was found to proceed too slowly for convenient kinetic study.

The cleavage reactions were therefore investigated in anhydrous dimethylsulfoxide (DMSO), in which the rate of reaction was many times faster than in the aforementioned solvent systems. Since an exceedingly slow reaction occurs between the HCl and DMSO, standard solutions of HCl in dioxane were employed. Except when specific solvent effects were studied, the DMSO to dioxane ratio was 10 to 1 throughout the investigation.

The reactions were followed conductometrically. Since it was verified that under the conditions employed in this study, compounds of the type R_2Hg and RHgCl offer negligible conductance, the rate of reaction could be followed directly from the decrease in the conductance of the solution with time.

The kinetic runs were made by dissolving a calculated amount of organomercury weighed out into a conductivity cell in 10 ml. of DMSO and allowing the solution to equilibrate in a constant temperature bath. Then 1 ml. of the HCl-dioxane solution was added and readings of the resistance of the solution taken at suitable intervals over about 75% of the reaction.

An extensive mechanistic study of the cleavage reaction covered the following points:

(a) The rate of reaction was shown to be dependent to the first power on the initial concentration of both the acid and organomercury, and hence of overall second order.

(b) The reaction rates were found to be strongly dependent on the nature of the organic group attached to mercury, the rates decreasing in the order: cyclopropyl> vinyl > phenyl ≫ ethyl > i-propyl > n-propyl > methyl.

(c) The effect of temperature on the reaction rate was determined and activation energies and entropies were calculated.

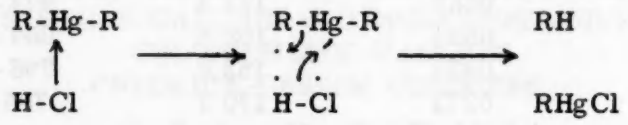
(d) The addition of dioxane to the reaction solution caused an increase in the reaction rate.

(e) The addition of water to the reaction solution caused a decrease in the reaction rate.

(f) Sulfuric acid, while apparently not alone reacting with organomercury under the conditions employed in this investigation, caused an increase in the reaction rate when added to the reaction solution.

(g) The effect of carrying out the reaction with DCl rather than HCl was determined.

The above results are in agreement with a four-center mechanism



in which nucleophilic attack on mercury is as important as electrophilic attack on carbon.

Supplemental to the kinetic investigation, a study of the Hg^{199} and H^1 nuclear magnetic resonance spectra of dimethyl-, diethyl-, di-n-propyl-, and di-i-propyl-mercury was undertaken. The Hg^{199} results indicate that the shielding of the mercury increases along the series Me < n-Pr < Et < i-Pr. It also appears as if this increased shielding is connected with an interaction of the Hg and the H atoms as evidenced by the H^1 resonance peaks and the Hg^{199}-H^1 spin-spin coupling peaks.

Microfilm $2.35; Xerox $8.20. 180 pages.

THE ABSORPTION OF CARBON DIOXIDE BY POLYMERIC AMINES.

(L. C. Card No. Mic 59-3635)

Jack Robins, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: Professor H. P. Gregor

The principle object of this investigation was to apply the modified Henderson-Hasselbach equation to the titration of weak-base polyelectrolytes with weak acids, particularly carbonic acid, and to determine the enthalpy, entropy and free energy of the reaction with carbonic acid.

In the titration of the hydrochloride of poly-N-methylethyleneimine, the hydrochloride of polyethyleneimine and the sulfate of polyethyleneimine, with potassium hydroxide, the amines behaved as multi-acidic bases. Poly-N-methylethyleneimine behaved as a diacidic base while polyethyleneimine behaved as if it were made up of four basic constituents of different base strengths. Although the polymer salt as a whole did not obey the modified Henderson-Hasselbach equation,

$$pH = \log K_{av.} - n \log \frac{\beta}{1 - \beta}$$

where β is the degree of ionization of a polymeric unit and n and $K_{av.}$ are constants, each of the basic constituents was found to fit this equation. The parameters n and log $K_{av.}$ were determined for each basic constituent.

In the titration of the free bases, polyvinylimidazole and poly-N-methylethyleneimine, with strong acids, the bases fitted the Henderson-Hasselbach equation. Both

appeared to be monoacidic bases, the second component of poly-N-methylethyleneimine being so weak that no indication of this component was detectable in the differential plot of the titration. The titer of poly-N-methylethyleneimine did not change with temperature and although log $K_{av.}$ decreased with increasing temperature, the parameter n appeared to be independent of temperature.

Polyethyleneimine appeared to be a diacidic base when it was titrated in approximately 0.01 N solution with a strong acid and it appeared to be a triacidic base when it was titrated in approximately 0.27 N solution with a strong acid. Each component fitted the Henderson-Hasselbach equation and appeared to belong to a definite titration region in the titration curve.

In the titration of polyvinylimidazole and of poly-N-methylethyleneimine with the weak acid, acetic acid, the degree of ionization of the polymer was calculated using the electrical neutrality law. The acetic acid titrations were found to fit the Henderson-Hasselbach equation.

The titration of polyethyleneimine with acetic acid did not fit the Henderson-Hasselbach equation owing to the multi-acidic nature of the base. However, the acetic acid titration could be separated into two components which did fit the Henderson-Hasselbach equation.

The absorption of carbon dioxide by solutions of polyvinylimidazole and of poly-N-methylethyleneimine were measured by saturating the solution with a calibrated mixture of carbon dioxide and nitrogen and by desorbing the solution at 80° with nitrogen, reabsorbing the evolved carbon dioxide in ascarite. The method was found to give reproducible results of reasonable accuracy.

The absorption of carbon dioxide by the neutral polymers, polyvinyl alcohol and poly-N-vinylmethylimidazolium iodide was found to be negligible indicating that there was no significant colloid effect in the absorption of carbon dioxide by the dissolved polymers. The absorption by sodium polystyrenesulfonate was small but significant, suggesting that the absorption was chemical rather than physical.

The absorption of carbon dioxide by various concentrations of polyvinylimidazole and poly-N-methylethyleneimine, with and without potassium chloride, was measured at 25°, 50° and 80°. From the values obtained, the parameters n, $K_{av.}$ and the reaction constant for the reaction,

$$R_3N\ (aq) + CO_2\ (g) = R_3NH^+ + HNO_3^-,$$

were calculated. From these values of the reaction constant, the free energy, the enthalpy and the entropy of this reaction were determined.

Microfilm $2.05; Xerox $7.20. 154 pages.

VIBRATIONAL ASSIGNMENTS OF TRIFLUOROACETIC ACID AND SOME OF ITS DERIVATIVES.

(L. C. Card No. Mic 59-3955)

Robert Eugene Robinson, Ph.D.
University of Michigan, 1959

The vibrational spectra of a series of simple organic compounds having the trifluoromethyl group in common have been investigated using principally Raman spectroscopy. The study of a sequence of similar molecules not only has aided in assigning fundamental vibrations of the various compounds but also has made possible the comparison of shifts of group frequencies as a result of coupling and chemical changes due to substitution. The compounds investigated in the present research were trifluoroacetic acid, trifluoroacetamide, trifluoroacetamidine, and both the monomethyl and dimethyl derivatives of the last two compounds. In addition, the methyl ester of trifluoroacetic acid, the sodium and silver salts of trifluoroacetic acid, and the silver salts of trifluoroacetamide and trifluoroacetamidine were included in the study. Raman spectra of several of the above compounds have been reported previously; however, because of incomplete assignments as well as the availability of more recent data, the spectra of all compounds merited reinvestigation. With the exception of the silver salts of trifluoroacetamide and trifluoroacetamidine, the Raman spectra of the above compounds have been obtained either as pure liquids or as aqueous solutions. The infrared absorption spectra of the silver salts of trifluoroacetamide and trifluoroacetamidine have been observed as mulls. Raman spectra of deuterated trifluoroacetic acid, trifluoroacetamide, and trifluoroacetamidine have also been obtained.

A vibrational assignment of the observed Raman bands of liquid trifluoroacetic acid has been made with the help of the Raman spectrum of the deuterated acid in the liquid phase and the previously reported infrared spectrum of the light acid in the vapor state. The results of the qualitative polarization measurements for deutero trifluoroacetic acid in the liquid state suggest that the associated species possesses C_1 symmetry. A similar conclusion for trifluoroacetic acid based on the latter's polarization data was less certain due to the presence of several highly depolarized bands in the Raman spectrum.

By a comparison of the spectra of the trifluoroacetamide series with those of the corresponding nonfluorinated analogues, assignments of the fundamental frequencies of the fluorinated compounds have been made. Vibrational spectra of the unsubstituted and substituted trifluoroacetamidines have not been reported previously. Assignment of the observed bands was attempted in terms of the results obtained for the amide series. In the case of N-methyltrifluoroacetamidine, the phenomenon of tautomerism is suggested as a possible explanation of the observed spectrum. The interpretation of the vibrational frequencies of the silver salts of trifluoroacetamide and trifluoroacetamidine is in agreement with the resonance hybrid of the carboxylate ion.

Microfilm $2.45; Xerox $8.60. 186 pages.

SIMULTANEOUS TRANSITIONS AND INTERMOLECULAR FORCES.

(L. C. Card No. Mic 59-3785)

Jerry Herbert Schachtschneider, Ph.D.
University of Minnesota, 1959

Van Kranendonk's theory of pressure-induced absorption has been applied to the calculation of intensities of simultaneous transitions. An expression was derived for the binary absorption coefficient of a simultaneous

transition in terms of the infrared and Raman intensities of the vibration-rotation bands involved and the intermolecular potential between the molecules of the pair. Intensities of several transitions in mixtures of SF_6, CF_4, SiF_4, and CO_2 with H_2, N_2, O_2, and CH_4 were calculated using a Lennard-Jones potential and compared with experimentally measured intensities giving generally satisfactory agreement. The measurement of simultaneous transition intensities was discussed as a possible method for studying intermolecular forces.

The enhancement of pressure-induced fundamentals by foreign gases was also considered.

Experimental measurements of the binary absorption coefficients of induced bands in SF_6-H_2 and SF_6-N_2 mixtures were reported.

Microfilm $2.00; Xerox $6.40. 134 pages.

PART I: THE CATALYTIC HYDROGENATION OF NITRO COMPOUNDS OVER SUPPORTED RHODIUM IN ACETIC ACID; PART II: THE EXCHANGE OF DEUTERIUM GAS AND METHANOL IN THE PRESENCE OF RANEY NICKEL.

(L. C. Card No, Mic 59-4261)

Burch Byron Stewart, Ph.D.
The University of Tennessee, 1959

Major Professor: Hilton A. Smith

PART I

The kinetics of the catalytic hydrogenation of the nitro group of several compounds have been investigated. The supported rhodium-acetic acid system was employed.

Nitrobenzene, beta-nitrostyrene, nitroethane, nitromesitylene and 2-nitro-1-butene gave kinetic behaviors which were first order with respect to hydrogen pressure. Nitromesitylene and nitroethane exhibited zero order acceptor dependence at high concentrations and first order at low concentrations. Nitrobenzene, beta-nitrostyrene, and 2-nitro-1-butene exhibited zero order dependence for all concentrations studied. Variation of the ratio of catalyst weight to acceptor concentration, in some cases, revealed the stepwise mechanism of the hydrogenation of the nitro group. In some cases the possible intermediates were indicated or identified.

A comparison with deuterium exchange data shows that the exchange effects are paralleled by the hydrogenation data. In general the Langmuir adsorption isotherm explains both the exchange data and hydrogenation data. The special effect of increased exchange in the case of nitromesitylene and nitroethane is discussed.

PART II

An improved effusiometry apparatus for analyzing hydrogen and deuterium mixtures was constructed and utilized to study the exchange reaction of deuterium with methanol over Raney nickel catalyst.

The exchange reaction was zero order with respect to deuterium pressure and pseudo-zero order with respect to methanol concentration. The apparent activation energy was found to be 3.5 kcal./mole. The specific reaction rate constant was 2.9 1. mm. $min.^{-1}$ $g.^{-1}$.

The effects of nitro compounds upon the exchange of deuterium with methanol over Raney nickel were studied. All of the compounds decreased the exchange at very low concentrations and all, except nitromesitylene, prevented the exchange at higher concentrations. Except for nitromesitylene, the effects paralleled the kinetics of catalytic hydrogenation of these nitro compounds under similar conditions.

Since Raney nickel can liberate hydrogen directly, a method for determining per cent exchange in its presence was developed. It was shown that the exchanged hydrogen did originate from the hydroxyl hydrogen of methanol.

Microfilm $2.05; Xerox $7.20. 155 pages.

PART I. THE DISSOCIATION CONSTANTS OF SOME SUBSTITUTED BENZOIC ACIDS IN 57.6 PER CENT ETHANOL. PART II. A PHYSICAL AND CHEMICAL STUDY OF POLYPHOSPHORIC ACID.

(L. C. Card No. Mic 59-4118)

Robert Marion Stone, Ph.D.
Vanderbilt University, 1959

Supervisor: Professor Donald E. Pearson

PART I

It has been observed previously that the total effect caused by adjacent alkyl groups on the migrating nucleus in the Beckmann rearrangement was not additive; the Hammett sigma-rho equation was not obeyed by these groups. Therefore it was desired to see if the same deviation occurred in a nucleophilic reaction. The dissociation constants of unsubstituted, 3,5-dimethyl-, 3,4,5-trimethyl-, 3,5-diethyl-, and 3,4,5-triethylbenzoic acids, as well as the dissociation constant of 4-nitrobenzoic acid were determined in a medium sufficiently alcoholic to dissolve all the acids. A potentiometric titration method was used, employing glass and Calomel electrodes in an inert atmosphere. A plot of log K/K_o versus sigma was approximately linear, which showed the substituent effects to be approximately additive in nucleophilic reactions. It was concluded that no inhibition of solvation in the transition state by substituent groups was taking place in the neutralization reaction, since this is considered to be one of the causes of deviation in electrophilic reactions. These data also indicate that no out of plane bending of the 4-methyl group by flanking substituents is taking place, because the bending would be inherent in both nucleophilic and electrophilic transition complexes, leading to similar rather than dissimilar behavior in both types of complexes.

PART II

The main objective of this work was a kinetic study of the Beckmann rearrangement in polyphosphoric acid, with

a view toward comparing the rate and mechanism of the rearrangement with the same one in sulfuric acid. A viscometric study of polyphosphoric acid was also undertaken, in the hope that some light might be thrown on the effect of viscosity on the rate of rearrangement.

Polyphosphoric acid was prepared under dry conditions in the range of 81-85% phosphorus pentoxide, and was found to have a refractive index which varied linearly with phosphorus pentoxide concentration in this range. Viscosities of solutions of varying concentrations and at different temperatures were determined using a Hoeppler rolling ball viscosimeter. Viscosities were observed to vary greatly in the small range measured. Using an equation of the type

$$\eta = AT^n e^{B/T},$$

it was observed that the temperature dependence of the viscosities obeyed this type equation with n = 1. Heats and entropies of activation for viscous flow were determined and were not observed to vary greatly with temperature.

The rate of rearrangement of acetophenone oxime was determined in four concentrations of polyphosphoric acid, and at three temperatures. It was found that the temperature dependence of the rates was in accordance with the Arrhenius equation. The rates of rearrangement of 4-methyl-, 4-chloro-, and 3-bromoacetophenone oximes were determined in polyphosphoric acid at one temperature. Extremely little variation in rate with substituent group was observed. Rho for this medium was calculated to be -.309. The rates of rearrangement in polyphosphoric acid were observed to be about 20 times as fast as those rates in sulfuric acid. Correspondingly, the energies of activation were much lower in polyphosphoric acid than in sulfuric acid.

The ultra-violet absorption spectra of acetophenone, 4-chloroacetophenone, 4-nitroacetophenone and anthraquinone were studied. From the shapes of the spectra in polyphoric acid compared to the spectra in isooctane, and the known pK_{BH} values of the ketones, the H_o value of polyphosphoric acid appeared to be less than that of 95% sulfuric acid. On the basis of this, and the observation that the rates of rearrangement of oximes in polyphosphoric acid are faster than those in sulfuric acid, it was concluded that the mechanism in polyphosphoric acid does not proceed through a protonated species. The other most logical mechanism is ester formation followed by dissociation.

Microfilm $2.00; Xerox $6.40. 135 pages.

PART I: A STUDY OF THE CATALYTIC HYDROGENATION OF HYDROXYBENZENES OVER PLATINUM AND RHODIUM CATALYSTS; PART II: THE KINETICS OF THE ACID-CATALYZED HYDROLYSIS OF THE DIMETHYL ESTERS OF CYCLOHEXANE-DICARBOXYLIC ACIDS.

(L. C. Card No. Mic 59-4262)

Billy Lee Stump, Ph.D.
The University of Tennessee, 1959

Major Professor: Hilton A. Smith

PART I

The catalytic hydrogenation of hydroxybenzenes over Adams platinum and 5 per cent rhodium on alumina catalysts has been studied. The kinetics of the hydrogenation were found to be first order in hydrogen pressure, zero order in acceptor concentration and directly proportional to catalyst weight. Activation energies were determined using the integrated form of the Arrhenius equation.

Hydrogenation of the aromatic ring was usually accompanied by some cleavage of the hydroxyl groups. The amount of cleavage was found to be dependent upon the catalyst used. Platinum led to extensive hydroxyl cleavage while rhodium catalyzed ring saturation with little cleavage. Both the reaction temperature and the structure of the acceptor were found to influence the extent of cleavage.

A mechanism for the hydrogenation of hydroxybenzenes has been proposed. This mechanism involves the formation of hydroxycyclohexene intermediates. Tautomerization of the hydroxycyclohexene to the keto form accounts for the formation of ketones during the course of the reaction. The carbon-oxygen bond is labilized by the β-γ carbon-carbon double bond in the hydroxycyclohexene and cleaves easily under these conditions.

No kinetic evidence was found for the formation of ketone intermediates, but the role played by ketones in hydroxybenzene hydrogenations was investigated.

A simple method of preparation for 1,3-cyclohexanedione was developed using resorcinol, low pressures of hydrogen, and 5 per cent rhodium on alumina catalyst.

The preparation of the 2,4-dinitrophenylhydrazone of 4-hydroxycyclohexanone has not been reported previous to this work.

The effect of substitution and number of substituents on the rate of hydrogenation was found to be about the same for the various hydroxybenzenes as for the corresponding methyl and methoxy compounds.

PART II

The dimethyl esters of the isomeric 1,2-, 1,3- and 1,4-cyclohexanedicarboxylic acids have been prepared and the rates of their acid catalyzed hydrolyses in 70 per cent acetone have been determined. All hydrolysis reactions were run at four temperatures, 25°, 35°, 45°, and 55°. The rate constants for the hydrolyses at each of these temperatures, along with the activation energies for the reactions, have been determined.

The rates of hydrolysis of the cis-1,3- and trans-1,4 diesters were found to be almost identical. Similarly, the reaction rates of the trans-1,3 and cis-1,4 diesters were found to be nearly the same. The cis- and trans-1,3-diesters reacted at much slower rates.

The relative reaction rates which were determined for the various diesters were taken to be indicative of the predominant inverted isomeric possibilities of the compounds studied. An ester with an exposed carbomethoxyl group would be expected to react at a faster rate than a similar compound whose carbomethoxyl group was not so exposed.

Using this idea, and with the aid of scale models of the various compounds, the results obtained in this work were explained by assuming that in the conformational equilibrium which exists with all the cyclohexane derivatives, the predominant conformation with the cis-1,2, trans-1,3, and cis-1,4 diesters was the axial-equatorial, while with the cis-1,3, trans-1,4, and trans-1,2 diesters the equatorial-equatorial conformation predominated. These similar inverted isomeric states explain the similar reaction rates noted. Microfilm $2.05; Xerox $7.20. 155 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

PART I: THE CHEMICAL EFFECTS OF LOW ENERGY X-RADIATION ON ION EXCHANGE RESINS.
PART II: A SPECTROPHOTOMETRIC STUDY OF THE THIOCYANATE COMPLEXATION OF NICKEL(II) IN DILUTE AQUEOUS SOLUTION.

(L. C. Card No. Mic 59-4120)

James William Utley, Ph.D.
Vanderbilt University, 1959

Supervisor: Professor Dwight C. Bardwell

PART I

The chemical effects of ionizing radiation are of expanding interest not only because nuclear reactors are attendant with such radiations but also because energizing of molecules by this means offers promise of contributing to the understanding of fundamental behaviors. The study of the consequences of irradiating ion exchange resins was selected as being of importance to their use in processing radioactive fission products and also representative of solid polymeric materials containing highly polar groups. In extending the work of previous investigators, emphasis has been placed upon quantitative evaluations.

Strongly acidic type exchangers manufactured by The Dow Chemical Company under the name Dowex 50 were studied exclusively. These are sulfonated styrene-divinylbenzene copolymers which were obtained in the solid bead form of 20 to 50 mesh size. Resins of 4, 8, 12 and 16% crosslinkage were irradiated with low energy x-rays produced by Vanderbilt's 50 kvp - 50 ma X-Ray Unit which employs a Machlett OEG-60 X-Ray Tube (1 mm thick beryllium window).

The resins were irradiated for periods of fifteen, thirty and sixty hours with the respective energy absorptions of 13.5-, 27.0-, and 54.0 x 10^{21} electron volts (ev) per gram of resin. Quantitative measurements were made of radiation-induced changes in the resin properties: weight, ion exchange capacity, sulfur content, selectivity of Cs^+ ions over H^+ ions, diffusion rate of Li^+ ions, water adsorption, benzene adsorption and resin-bed density.

Weight losses increased with the amount of energy absorbed and were highest in the lowest crosslinked materials amounting to 12.9% in the latter after sixty hours.

Ion exchange capacities decreased in about the same pattern for all degrees of crosslinkage. The rate of loss was greater in the initial period of radiation. Losses after sixty hours were typically 20%.

Losses in sulfur content (initially present as $-SO_3H$) increased with amount of energy absorbed running closely parallel with ion exchange capacity losses. No significant amounts of carboxylic acid groups or sulfone-type linkages appear to have been formed.

Values of the selectivity coefficient for the $Cs^+ - H^+$ exchange reaction decreased with energy absorption.

The rate of diffusion of Li^+ ions into the resin particles showed an initial increase which was followed by a continued decrease. The increase was due to radiation-induced cracking and shattering of the resin spheres and, thus, the production of increased surface area. The subsequent rate decrease was indicative of radiation-induced cross-linking.

The ability of the sulfonated resin, as manufactured, to adsorb water from controlled pressures of water vapor is known to decrease with increasing crosslinkage and was found to decrease with the amount of energy absorbed. Irradiation effects were indicative of further crosslinking of the hydrocarbon lattice, since less water was adsorbed by samples which absorbed more energy. The initially higher crosslinked resins showed relatively less change attributable to irradiation.

The ability of resins to adsorb benzene from controlled pressures of benzene vapor is associated with the hydrocarbon lattice containing benzene rings. Irradiation caused a decrease in benzene adsorption which indicated that induced crosslinking lowered the solubility of benzene in the hydrocarbon lattice.

The bed density of the resins increased with energy absorption, another indication of crosslinking. This was especially true for the lower crosslinked resins. The initially 4% crosslinked resin showed a 46% increase after sixty hours of irradiation.

In summary, this study established that the principal changes upon irradiation are losses of sulfur and, correspondingly, ion exchange capacity. They are significant but not strikingly large. There is further crosslinkage with relatively little fragmentation or scission of the polymeric lattice.

The radiation stability of the resin for exchange process use is inversely proportional to the decrease in ion exchange capacity. In irradiating Dowex 50-X4 for a fifteen-hour period G (G represents the number of ion exchange groups lost per 100 ev of energy absorbed) was 3.2, and for thirty- and sixty-hour periods, 1.7 and 1.4, respectively. Thus, during the fifteen-hour period 31 ev were required to destroy an ion exchange center, whereas during a sixty-hour period 70 ev were required. Hence, with increasing irradiation more energy is required to release an acid group. Furthermore, these energy requirements are very high compared with those for polymerization of unsaturated hydrocarbons. They may be due to the ability of the benzene ring to absorb and dissipate energy without chemical change.

The results of this study suggest that irradiations of other sulfonated hydrocarbons such as benzene sulfonic acid would yield information pertinent to energy transfer mechanisms when ionizing radiation is absorbed.

The use of soft x-rays for irradiating solids or liquids offers means for introducing large amounts of ionizing energy with relatively small and inexpensive equipment. Apparently, their use has been retarded by lack of suitable calibration techniques. In the present work a method was developed which is accurate and simple. It is free from the geometric corrections usually required of ionization meters. It involves the oxidation of ferrous iron in aerated, acidic, aqueous solutions.

Using resin samples weighing 0.5 gram spread out evenly in a circular area of 30 mm in diameter, the energy absorption was 15 x 10^{18} ev per minute per gram. This input rate is about 40 times that obtainable in the Co^{60} irradiator of this laboratory.

This calibration technique involves a difference method which is applicable to any filter in sheet form.

PART II

Dilute aqueous solutions of nickel(II) and thiocyanate with concentrations up to 0.03 molar were studied spectrophotometrically in the ultraviolet region of the spectrum. "The method of continuous variations" of Job (1) was used

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

to determine the mole ratio of nickel(II) to thiocyanate in any complexes that were present. The ionic strength was maintained constant at 2.00 by using sodium perchlorate. All measurements were made at room temperature which was constant at 25 ± 2°.

The ultraviolet spectrum due to complexation consisted of a curve in the range from 250 to 300 millimicrons. A wave length of 270 millimicrons was selected for making measurements. The absorption curve was due solely to the absorption of the $Ni(CNS)^+$ ion for the concentration employed.

The formation constant, K_f, of the $Ni(CNS)^+$ complex was calculated to be 18.7 ± 1.0.

Microfilm $2.25; Xerox $8.00. 171 pages.

ELECTROCHEMICAL STUDY OF FUSED SALTS.

(L. C. Card No. Mic 59-4047)

Anthony Flory Wilde, Ph.D.
Indiana University, 1959

Previous investigations have utilized two methods to determine E^0 of formation of fused metal halides: the equilibrium cell method, which requires several components in a cell container inert to all these components; and the decomposition potential method, which requires a relatively simple cell whose container is in direct contact with only the fused salt, but which is subject to overvoltage effects. The ohmic portion of this cell overvoltage has been minimized by use of a modification of the decomposition potential method, namely the commutator method, which utilizes a mechanical commutator. However, this modification is subject to errors resulting from diffusion of the decomposition products away from their respective electrodes. Results obtained by these methods have in the past shown discrepancies even among values obtained by the same method.

In the present investigation an electronic commutator was designed and constructed for the generation of cell current pulses and for the measurement of the resultant cell potential at any time between these pulses. The latter portion of the cell potential curve between pulses was extrapolated back to the time of cessation of the preceding pulse to obtain the cell potential free of errors due to diffusion of decomposition products and overvoltage effects. The resulting potentials were used to calculate thermodynamic quantities of formation of fused metal halides.

Two pairs of electrodes in contact with a common AgCl(1) phase were used to make simultaneous direct comparisons between the equilibrium cell method and the electronic commutator method in the temperature range 500° to 907°C. Resulting E^0 values for the formation of AgCl(1) differed by 0 to 6 millivolts. The commutator method appeared to be the more stable at temperatures over 800°C. The commutator data led to thermodynamic values agreeing well with results obtained by other investigators.

The commutator method was also used to determine E^0 for the formation of $PbCl_2$(1) in the temperature range 547°-725°C. With this cell a larger overvoltage was observed after each pulse than with the AgCl cell. This introduced more uncertainty in the extrapolated cell potentials. The resultant thermodynamic values agreed fairly well with those of other workers, although at higher temperatures the temperature dependence of the author's data showed an increasing variance with other investigations.

Supplementary measurements of the decay of the AgCl cell potential indicated that interstitial compound(s) of carbon, chlorine, and AgCl may be formed at the graphite electrode surface under conditions of electrolysis. The interaction of electrode materials with fused salt and chlorine under such electrolysis conditions must be studied further to apply this commutator method to other fused halides. Further improvement in the precision of measurement and in the selection and maintenance of cell components will yield quantitative information about the kinetics of overvoltage decay and halogen diffusion. Present observations can be explained only qualitatively.

It is concluded that this electronic commutator method yields E^0 values of formation of fused metal halides as accurately as other methods and can also be utilized for the study of certain kinetic processes in the cell.

Microfilm $2.00; Xerox $5.20. 105 pages.

LIGHT-SCATTERING AND VISCOSITY STUDIES OF A POLYELECTROLYTE AND POLYSOAPS DERIVED FROM POLY-4-VINYLPYRIDINE.

(L. C. Card No. Mic 59-3613)

Bernard Leo Williams, Ph.D.
Rutgers University, 1959

Major Professor: Ulrich P. Strauss

Poly-4-vinylpyridine was prepared and carefully fractionated. A high molecular weight fraction (M_w = 2.00 x 10^6) was obtained. The light-scattering and viscosity results indicate that the fraction was not homogeneous.

Five poly-4-vinylpyridine derivatives were prepared by quaternizing 0.0, 4.8, 10, 16, and 34% of the nitrogens of the fractionated poly-4-vinylpyridine with lauryl bromide and the remainder of the nitrogen with ethyl bromide. However, in the necessary quaternization and purification reactions, degradation and an undetermined amount of fractionation negated most of the advantages of a fractionated parent polymer.

These polysoaps were studied in a non-aqueous system of LiBr/IPA by means of light-scattering measurements. The behavior was normal. The molecular weights were determined and the polysoap-solvent interactions were calculated. It was found that the solubility increased with increasing lauryl content. Moreover, the theta point dimensions increased with lauryl content, as would be expected with the increased steric hindrance.

These polysoaps and the polyelectrolyte were also studied in an aqueous system of KBr/H_2O by means of light-scattering and viscosity measurements. The polyelectrolyte behaved normally. The behavior of the polysoaps, however, was found to be far from that of the normal polyelectrolyte. As the lauryl group content is increased, the polysoaps exhibit a tendency to aggregate in solution, with the greatest degree of aggregation occurring in the case of the polysoap containing 10% lauryl bromide. These aggregations were evidenced by the large negative values of the second virial coefficients when the solutions were prepared

individually, and by the normal values when dilution runs were made. Moreover, the molecular weights obtained from the dilution runs were those of the aggregates, whereas those obtained from the individually prepared solutions were closer to the molecular weights of the polysoap molecules. In addition, as the lauryl group content is increased the size of these polysoap molecules does not increase but rather the molecules become more compact. That is, the theta point dimensions decrease with increasing lauryl group content. This behavior is ascribed to aggregation of the lauryl groups within one polysoap molecule.

Microfilm $2.00; Xerox $6.60. 140 pages.

DIFFUSION OF ZINC AND OXYGEN IN SINGLE CRYSTALS OF ZINC OXIDE.

(L. C. Card No. Mic 59-4048)

Elmer Lee Williams, Ph.D.
Indiana University, 1959

Major Professor: Walter J. Moore

The diffusion of zinc in zinc oxide by a radioactive tracer method and the diffusion of oxygen in zinc oxide by oxygen exchange has been measured. The diffusion coefficient for the diffusion of zinc 65 in large, clear, transparent, single crystals of zinc oxide exposed to an oxygen atmosphere has been determined over the temperature range 1000^0 to 1265^0C and is represented by $D = 1.25 \times 10^{-5} \exp(-43.5 \text{ kcal/RT}) \text{ cm}^2 \text{ sec}^{-1}$. The probable errors in the frequency factor and the activation energy are $\pm 30 \text{ cm}^2 \text{ sec}^{-1}$ and $\pm 10 \text{ kcal mole}^{-1}$, respectively. With this D at a reference temperature of 1200^0C and with a jump distance for Zn to nearest neighbor Zn of 3.21 A the parameters of the Eyring equation were found to be $\Delta H^{\ddagger} = 41.0 \pm 10.$ kcal and $\Delta S^{\ddagger} = 13.3 \pm 6.4 \text{ cal deg}^{-1}$. These are the only diffusion measurements on the zinc oxide system where large single crystals were carefully sectioned. The sectionings were done on a precision grinder.

The diffusion coefficient for oxygen diffusion in the clear, transparent, single crystals of zinc oxide was determined over the temperature range of 1100^0 to 1300^0C by measuring the exchange of oxygen enriched with oxygen of mass 18 with the zinc oxide crystals inside a platinum reaction vessel. The amount of oxygen exchange was measured by observing the decrease in the 34/32 mass ratio of the oxygen by the use of a mass spectrometer. The amount of oxygen exchange was correlated to the diffusion coefficient for the oxygen diffusion in zinc oxide and is represented by $D = 6.52 \times 10^{11} \exp(-165 \text{ kcal/RT}) \text{ cm}^2 \text{ sec}^{-1}$. The probable errors of the frequency factor and the activation energy are $\pm 17 \text{ cm}^2 \text{ sec}^{-1}$ and $\pm 6 \text{ kcal mole}^{-1}$, respectively. Relating the D at 1200^0C with Eyring's equation using a jump distance of 3.21 A for oxygen atom to nearest neighbor oxygen atom gives $\Delta H^{\ddagger} = 162 \pm 6$ kcal and $\Delta S^{\ddagger} = 59 \pm 4 \text{ cal deg}^{-1}$.

In conjunction with the zinc diffusion in zinc oxide measurements were made on the solubility of zinc in spectroscopically pure zinc oxide by chemically analysing the zinc oxide for excess zinc after exposing the zinc oxide to zinc vapor at high temperatures. The temperature range of measurement was 925^0 to 1075^0C and the heat of solution was found to 3.5 kcal/mole. Also some observations were made on the rate of evaporation of zinc oxide single crystals on exposure to zinc vapor and to oxygen. It was observed that oxygen suppressed the rate of evaporation while zinc vapor enhanced it. It is suggested that the zinc vapor acts as a catalyst in the evaporation of zinc oxide for it has been reported that no suboxide of zinc exists.

A discussion of diffusion in zinc oxide as has been reported in the literature up to now is given along with the possible mechanism for diffusion.

Microfilm $2.00; Xerox $5.60. 114 pages.

ECONOMICS, GENERAL

ECONOMICS OF THE COTTON TEXTILE INDUSTRY OF THE USSR, 1928-1955

(L. C. Card No. Mic 59-4054)

Abraham Samuel Becker, Ph.D.
Columbia University, 1959

This study of the growth and operation of the Soviet cotton textile industry, concentrating on the period 1928-1955, has two principal aims: to study the workings of Soviet economic planning by focusing on a single branch of manufacturing, and to examine in detail the process of diverting resources from a major consumer's goods industry for the use of heavy industry, as a case study of Soviet investment priorities.

In the period 1928-1955 the pace of Soviet industrialization was so rapid that the USSR became the second industrial power of the world. In contrast, the cotton textile industry consistently failed to meet plan goals; cotton textile output increased at a rate far lower than did production in the backbone of Soviet power, heavy industry; the rate of growth of Soviet cotton textile output was exceeded by that of the American cotton industry in comparable periods of the latter's history. Considering the quantity, composition and quality of the goods the Soviet consumer received, there was a marked decline in real consumption of cotton textiles in the 1930's which was not made good until the 1950's.

The relative stagnation of the Soviet cotton industry was the consequence of relegation to the lower end of the scale of Soviet investment priorities at the inception of the Five Year Plans in 1928-1929. The history of the cotton industry in this period begins with a crisis of raw material supply and is marked throughout by dearth of investment funds and by diversion of planned investment resources to industries with higher priority. Because of the low level of investment, the rate of growth of output per manhour in the cotton industry compared unfavorably not only with that of Soviet industry as a whole but with that of the U.S. cotton industry as well. Given the material supply, the most important means of increasing output has been to increase the intensity with which available resources were utilized, primarily by multi-shift operation.

Low priority status was a prevading, determining characteristic of the entire environment of cotton textile development. Investment deprivation restricted the ability of the cotton industry to utilize effectively the resources which it could obtain because investment decisions could not satisfy the requirements of both ideological orthodoxy and efficient allocation. On the other hand, the low priority status of the cotton industry did not lead to the imposition of relatively more stringent financial discipline. Costs were a secondary consideration in the cotton textile industry in this period as in the Soviet economy generally. Because of structural weaknesses in the planning system and weak controls, direction of the cotton industry was unable to secure effective compliance with the aims of Soviet financial planning.

The next decade will likely see only a moderate rate of growth of cotton textile output. Confronting diminishing returns in cotton culture, due to limited land resources and diminishing returns to application of fertilizers, Soviet planners have resolved on gradual replacement of cotton by synthetic fibers. The pace at which this replacement and the growth of textile output as a whole proceeds will depend on the volume of resources the Soviet Union will be willing to spare from high-priority uses in other sectors of the economy.

Microfilm $4.90; Xerox $16.40. 383 pages.

SOVIET MANPOWER: THE POPULATION AND LABOR FORCE OF THE U.S.S.R.

(L. C. Card No. Mic 59-4060)

Warren W. Eason, Ph.D.
Columbia University, 1959

The present thesis consists primarily of the presentation and examination of statistical information on the size and composition of the labor force of the U.S.S.R., and on the relationship of the labor force to the population, by age and sex. In addition, there are discussed in general terms some of the more evident relationships between population and labor force growth and economic and social change under Soviet conditions.

Chapter 1 deals with the scope and direction of the thesis and its relation to other works in English, and with the question of the "reliability" of the primary data as well as of the estimates on which a major portion of the thesis is based.

Chapter 2, on the demographic characteristics of Soviet population growth, examines the size of the population, the rate of growth and the structure by age and sex. Particular attention is paid to the sharply lower peacetime birth and death rates compared to preplan years. The lower birth rate is analyzed in terms of rural-urban migration and changes in age-specific fertility rates and in the sex ratio. The lower death rate is seen to reflect the lower rate of infant mortality, the lower birth rate itself and a general improvement in conditions affecting mortality. Changes in the structure of the population by age and sex, toward a relative decline in the population of younger ages, a relative increase in the population of working ages and a lowering of the sex ratio, are traced in part to these changes in the pattern of population growth, but also to the affects of several periods of national crisis that have occurred in the present century (e.g., World War II). An estimate of the population by sex and five-year age-groups for selected postwar years is made on the basis of fragmentary non-census information, made available prior to the all-Union census of 1959; and a projection of the population in

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

five-year intervals to 1975 is made on the basis of alternative assumptions with respect to fertility and mortality.

Chapter 3, on population growth and labor force trends, presents data on the labor force per cent of the population by age and sex. Concepts and problems of measurement are discussed in detail, with particular attention to the data from the 1926 census. On the basis of relationships established for 1926, and in the absence of readily available data after the early plan years, an attempt is made to estimate the changes in the labor force per cent of the population under the plans, including the postwar years. The essential characteristic of these relationships is a higher percentage of the population in the labor force than in most other countries, particularly with respect to females. Given the projection of the population as set forth in Chapter 2, a projection of the labor force to 1975 is constructed on the basis of assumptions with respect to the future changes in the labor force per cent of the population by age and sex.

Chapter 4, on the economic characteristics of the Soviet population and labor force, covers the distribution of the population (a) between rural and urban areas, (b) by dependency on agricultural and nonagricultural occupations, and (c) according to the major socio-economic groups. Years of principal change (e.g., 1931) are examined against the overall change in the urban and nonagricultural population, from approximately 20 to 50 per cent of the total. The distribution according to the major socio-economic groups (wage and salary workers, collective and private farmers, co-operative and nonco-operative handicraftsmen, "bourgeoisie," the military and others) involves the construction of a consistent series which includes annual measures from 1924 to 1940, inclusive, and a postwar estimate as of 1955.

Chapters 5 and 6 present details on the agricultural and nonagricultural sectors, respectively, of the labor force, including changes in the number of males and females and the distribution by broad age-groups for some of the major economic sectors. The latter include wage and salary workers and co-operative handicraftsmen, in the nonagricultural labor force, and collective farmers and wage and salary workers, in the agricultural. Overall changes as well as departures from trend are interpreted.

In Chapter 7, two measures of the labor force are compared with each other and with a measure of the yearly average number of persons working or employed. The first measure of the labor force is that based on age- and sex-specific relationships to the population (Chapter 3) and the second on the sum of data by reported economic categories (Chapter 4). Alternative explanations are offered for the existence between the two measures of a residual of varying amounts for different years. The average annual number of persons actually working or employed per cent of the labor force is seen to increase during the five-year plans, due to the large-scale migration of labor from seasonal work in agricultural to more or less full-time work in industry, and to the increase in labor intensity on the farms.

Finally, there are presented 19 statistical appendices, in which the sources and methods for obtaining the data used in the text are set forth in detail. A bibliography of sources in Russian and English used in preparing the thesis is also included.

Microfilm $6.50; Xerox $22.40. 510 pages.

THE CANADIAN DOLLAR, 1950-57: A STUDY OF RATE STABILIZING FACTORS IN A FLEXIBLE EXCHANGE MARKET

(L. C. Card No. Mic 59-4004)

William Ray Gardner, Jr., Ph.D.
Indiana University, 1959

A case study of the Canadian dollar, 1950-57, provides an empirical contrast with the International Monetary Fund system of exchange rates. The latter system frequently has been criticized for its alleged rigidity. Continued resort to direct controls as a means of reconciling the conflicts between external and internal balance has been attributed to this system. A flexible exchange rate system has been suggested as a superior means of reconciliation. It is not, however, without its possible dangers. IMF reports emphasize the dangers of exchange rate instability and opponents of flexible rates point to the experience of the 1930's to support the allegation that flexible rates are unstable. Canadian experience during the 1950-57 period contradicts the proposition that flexible rates are necessarily unstable.

Several factors favored exchange rate stability in the Canadian case. First, cyclical and secular adjustment in Canadian receipts and payments were made with considerable ease. Cyclical trade adjustments reflect parallel fluctuations in Canadian exports and domestic investment. Imports typically adjusted to moderate movements in Canadian domestic investment and income; i.e., Canada apparently has a high "reflection ratio." Offsetting movements in the current-account and long-term capital account transactions reflect the common dependence of these transactions on relative Canadian and foreign cycle intensities.

Second, the long-run efficacy of the price mechanism favored exchange stability. The broad range of products in Canadian import and export lists reveal numerous substitution possibilities between home produced and imported goods on the one hand and between Canadian exports and the exports of major rivals in third markets on the other.

Third, short-term capital movements were responsive to exchange rate movements. Seasonal adjustments, cyclical and secular income adjustments, and price-induced trade adjustments provided participants in Canada's foreign exchange market with a firm basis in experience for anticipating exchange rate stability by contributing to inelastic market expectations. The Canadian experience suggests a need for re-assessing the view that short-term capital movements are likely to be destabilizing.

Fourth, Canadian Government policies made important contributions to exchange rate stability. Moderate intervention in the exchange market contributed directly to exchange stability. Official foreign exchange reserves were sufficiently large to assure that external disturbances could be cushioned. Large exchange reserves probably contributed indirectly to stability by creating confidence in the authorities' ability to maintain stability.

Exchange policies facilitated adjustments by permitting private dealings to have a stabilizing influence. Monetary and fiscal policies, by restraining inflationary pressures, prevented depreciation of the Canadian dollar and created confidence basic to capital inflows and to strength in the Canadian position. It should be added, however, that Canadian experience was not free of conflict between stability and internal balance.

Generalization from Canadian experience is extremely dangerous. Many special circumstances in the Canadian case are probably non-duplicable. The general character of government policies may, however, offer some important lessons. It is particularly interesting in this regard to note the parallels in Canadian and recent experiments with floating exchange rates in the Latin American countries. Enthusiasm for Canadian accomplishments must be tempered, however, by the realization that the Canadians experimented from a position of strength.

Microfilm $7.65; Xerox $26.20. 604 pages.

THE IMPACT OF INDUSTRY ON A RURAL AREA IN NORTHERN VIRGINIA: A CASE STUDY OF DEVELOPMENT IN WARREN AND SURROUNDING COUNTIES, 1930-1954

(L. C. Card No. Mic 59-4240)

Alexander Henderson Morrison, Ph.D.
University of Virginia, 1959

This thesis analyses the growth of industry in a rural area of the South. A single instance of development in a county in northern Virginia is examined with the objective of forming a framework by which to assess the nature of similar instances of rural industrialization. The study centers on development in Warren County in response largely to the establishment there in 1940 of a plant of the American Viscose Corporation. Employment at the plant has ranged between two and three thousand, as much as the urban population of the county in 1940, one-third the county total at that time.

The method rests on analysis of census data relating to: changing demographic patterns; adjustments in the structure of occupations and of industry; the reorganization of commercial functions; and to changes in the composition, level and distribution of income. The characteristics of the labor market of this industrial unit were examined through means of a distributed questionnaire. Patterns of union organization were also studied. A special feature of the analysis rests on comparisons between the industrializing area and two contiguous rural counties. The period covered is from 1930 to 1950.

The dynamics of growth in terms of human resource reallocation are revealed by population flow patterns. Marked inflows occurred in gross terms and by selected age groups for the developing areas, these revealing important increase in the proportion of workers in their most productive ages, economically, while the proportions of the aged and of children were decreasing. The implications relate to improvement in real income from this age redistribution alone, as well as to a lessened burden in the support of the young and the aged. Contrary findings hold for adjacent rural areas, which, while sharing in some degree in the new industrial development remain relatively unfavorably affected in terms of the population changes described. Adjustments in occupational and industrial classifications reveal important shifts from agricultural production to secondary and tertiary activity. The implications are of rise in real income, relief from common labor assignments and increase in skilled employments. While women fared less favorably than men, they gained in new job openings, these being principally in trade and in industrial operative assignments. Negroes fared less well, although gain was made in advance in skill and relief from menial tasks. Negro women were least affected.

Distributional functions, represented by retail and wholesale trade, changed under the impact of growth, the allocation of sales among the standard sub-groups revealing evolution to a more comprehensive functional form, as judged by state patterns. Income changes reveal rise in real levels, relatively more so in the developing county. Too, evidence is of a decrease in inequality of distribution in Warren County as industrialization proceeded.

Survey results indicate areas of recruitment of workers (sixty per cent from within a radius of fifty miles of the center, none beyond thirty-five), evidence of urban build-up and of redeployment from town to country. Other characteristics relate to skill, education, age, tenure, previous employment.

Examination of unionization reveals the major importance of multi-plant contract, lack of anti-union feeling among workers, stage of national organizing as conditioning forces. Traditional analysis in terms of organizing as a protest against capitalism or marked feeling of class or job consciousness appears to have little application in this instance.

In summary, this study details comprehensively a local instance of rural industrialization in terms which permit analysis of resource reallocation, in particular the labor factor, and which also made possible an assessment of the economic changes likely to occur in similar instances of rural growth. Microfilm $5.05; Xerox $16.80. 394 pages.

RECIPROCAL TRADE AGREEMENTS PROGRAM, 1945-1955

(L. C. Card No. Mic 59-2643)

Francis Murans, Ph.D.
Michigan State University, 1957

The idea of reciprocal trade agreements was conceived a long time before the passage of the Reciprocal Trade Agreements Act of 1934. Both major parties had advocated it as beneficial to national interests. Its adoption in a restricted form can be traced in the Tariff Acts of 1890, 1894, and 1922. Economic conditions of the early 1930's led the Congress to the adoption of this idea in a workable form, though it contained a number of restrictive features.

The importance of the reciprocal trade agreements program was enhanced after the World War II by the need for the expansion of markets for the goods of the expanding economy of the United States. The Reciprocal Trade Agreements Act of 1945 granted increased power to the Chief Executive to carry out these objectives.

The Administration had, however, more ambitious plans than bilateral reciprocal trade agreements of the 1930's. It saw an opportunity of establishing a multilateral trade agreements program which would lead to closer cooperation among the nations in the creation of prosperity and peace. The adoption of the Bretton Woods proposals and establishment of the General Agreement on Tariffs and Trade was an unprecedented step in that direction. This

trend toward international cooperation, however, was severely restricted after 1948.

Because of an increase of foreign competition in the markets of the United States and because of the threat of Soviet Russia's aggression, the advocates of protectionism rallied and the Congress passed in 1948 a restrictive Trade Agreements Act. Since then there has been a trend towards more and more protectionism. It was characterized by the reluctance of the Congress to extend the Act which resulted in short one or two year extensions. The main feature of the restrictive legislation, however, was the insertion of limiting provisions in peril point and escape clauses.

There was, moreover, a lack of interest on the part of the Congress to approve the International Trade Organization and more recently it has been unenthusiastic concerning the proposed Organization for Trade Cooperation.

The potentiality of trade restriction by the peril point and escape clause provisions were mitigated by a flexible administration of the Act by the Executive. Among the efforts of the Administration to change the trend toward restrictionism were appointed various commissions, such as those headed by Gray, Bell, Douglas and Randall. The reports of these commissions urged the need for a liberal trade policy. Microfilm $3.90; Xerox $13.20. 302 pages.

A SURVEY OF ECONOMIC SECURITY PROGRAMS IN MICHIGAN

(L. C. Card No. Mic 59-3760)

Jean Richardson Pearman, Ph.D.
University of Minnesota, 1959

Adviser: John G. Turnbull

This thesis focuses upon a selected group of economic and social problems involved in satisfying human security needs. To keep the study within manageable bounds, economic security programming in the State of Michigan was selected for particular analysis. The major areas of consideration include:

1. An appraisal of the extent of economic insecurity in Michigan.
2. An exploration of the causes of economic insecurity.
3. An evaluation of the state's efforts to help individuals who face problems of economic insecurity because of substandard earnings or loss of income.
4. An effort to make some policy recommendations which might reduce problems of economic insecurity without reducing economic welfare.

The study summarizes and synthesizes existing primary and secondary research and interpretive materials. Incomes from all sources are measured against an established minimum adequate budget. Economic security program comparisons with other States are made.

The analysis indicates that approximately 761,000, or one-third, of Michigan's families had substandard incomes in 1956. This estimate is based on a $5000 minimum annual budget for a family of four which was adjusted to the median size of families in the various income brackets.

Causes of substandard incomes are evaluated with reference to (1) low earnings arising out of inadequate training, low productivity and/or unfavorable bargaining power in the labor and agricultural products markets, and (2) loss of income due to unemployment, accidents and illnesses, old age, physical infirmities, and loss of the breadwinner through death or separation.

Based upon various standards, one may conclude that Michigan's efforts to help individuals meet problems of economic insecurity are not especially strong. Actual unemployment compensation payments are relatively high when compared with other States, but only one-third of the wages lost are recovered through benefits paid to unemployed. Michigan ranks with Washington in having the lowest basic recovery rate under workmen's compensation in the nation. All public assistance grants average below minimum adequate income standards, but Aid to Dependent Children grants per recipient average approximately one-half the amount of grants in the other categories.

The Michigan tax system is basically regressive and, although the lowest income bracket receives more benefits than it pays out in taxes, to an appreciable extent, the poor are being taxed to help the poor.

Certain administrative and structural conditions additionally and adversely affect economic security programs. For example, disproportionate representation in the legislature gives conservative minorities veto power over the actions of more liberal majorities. Administrative duplication is such as to reduce effectiveness in tax collection and public assistance administration.

Recommendations which are made include:

1. Re-apportionment of the state legislature so that each member of each house represents approximately the same number of people.
2. Combination of the bureaus of social aid and the county welfare offices and determination of definite standards for direct relief.
3. Extension of the civil service system to probate court and county welfare social work personnel.
4. The enactment of a progressive state income tax and a tax on the net profits of business with a reduction of the sales tax and the abolition of present business taxes if tax returns are adequate under the new tax system.
5. Strengthening of the unemployment compensation program through extended coverage, increased grants of longer duration, and the use of the level tax on employers and employees instead of the experience rating system.
6. Extended coverage and increased benefits under workmen's compensation with improved facilities for vocational rehabilitation.
7. Increased public assistance grants.
8. Enactment of a minimum wage law.
9. Improvement and expansion of the public health and mental health programs.

Microfilm $3.65; Xerox $12.40. 283 pages.

DEMOGRAPHIC CHANGES AND ECONOMIC GROWTH IN INDIA: A STUDY OF SOME BASIC ISSUES IN THE INDIAN ECONOMY SINCE INDEPENDENCE

(L. C. Card No. Mic 59-4243)

Som Prakash, Ph.D.
University of Virginia, 1959

The present study concerns itself with the basic problem of India's poverty in view of its considerable present

population and the promise of substantial gains that the coming decades hold in latter respect. A twofold task of this study is to specify the conditions of economic growth and to examine critically adopted and proposed policy measures which would seem to contribute to the chief goal of lifting real per capita incomes.

Although India's present factor endowment is kept constantly in view in proposing beneficial economic measures, the demographic trend is found slow to change and reversible only in the long run. Consequently, emphasis is laid on pressing forward the forces of economic growth which alone eventually would seem to promise the achievement of a "stable" population.

The study starts with a discussion of priorities in India's economic goals. The goal of income redistribution is found to be a poor substitute for and, if pushed vigorously, a dangerous accomplice to the goal of raising real income levels. Subsequently, the conditions of economic growth are specified and the implications of a rapid population increase are brought out for a program of economic regeneration.

After a survey of some basic historical data, the study analyses the country's unemployment problem in its demographic and economic aspects. As a result of a continuously high birth rate and a declining death rate, it is found that India has an age structure which is hostile to economic development. Consequently, it is necessary that India should make the most effective use of her manpower if substantial victories over her unfavorable age structure are to be won. Attempt is also made to discern the influence of rising urbanization on issues pertaining to the study. Finally, an effort is made to discover and probe into productivity differentials in the various sectors. On the basis of the latter, some recommendations with regard to occupational changes are made to achieve the same basic goal of a rise in living standards.

While analysing the unemployment problem, the Keynesian explanation for and remedy to this problem is found to be lacking. The problem of unemployment is inextricably bound with the problem of low production levels. Further on, the labor policies and education programs are given miscroscopic treatment for capturing the chief aim of increased prosperity.

In studying the capital formation schemes in agriculture and industries, those techniques are found to be useful which will activate idle resources with the minimum of monetary rewards. Exceptions to this rule, however, are recognized and accepted. In the use of scarce capital resources, there is paramount necessity for watching the capital-output ratios in various sectors and achieving interdependence in the economy. Viewed from this angle, building of an industrial or occupational structure for its own sake is found to be inimical to economic progress.

A distinct "welfare" bias is discovered in government's economic policies which somehow needs to be corrected. Also the evidence points to an excessive role of the government in the economic field acting against the rise of an entrepreneurial class.

Generally speaking, resources are inadequate for meeting the investment targets; furthermore, methods for filling the gap are faulty, clearly spelling inflation. The threat of inflation is built in in recent development plans: in relative neglect of agriculture, unproductive nature of much public spending, and a heavily capital- and import-intensive development. Here a shift in priorities is necessary for achieving smooth economic progress. Finally, brief attention is given to the international trade as it influences and is influenced by rapid economic growth.

Microfilm $4.65; Xerox $15.60. 361 pages.

THE IMPACT OF UNIONISM ON WAGE-INCOME RATIOS IN THE MANUFACTURING SECTOR OF THE ECONOMY

(L. C. Card No. Mic 59-3765)

Norman James Simler, Ph.D.
University of Minnesota, 1959

Adviser: John G. Turnbull

The main purpose of this study is to test the hypothesis that there exists a positive correlation between the growth of unionism in the manufacturing sector of the American economy and changes in the ratio of production and related workers' wages to value added by manufacture. No significant correlation could be established, and the hypothesis was therefore rejected.

The wage-income ratios were computed for certain manufacturing industries from data contained in the Census of Manufactures for 1947 and 1954 and the several Annual Surveys of Manufactures. Equations of linear trend lines, each showing the regression of the wage-income ratio on time, were determined for each of 36 industries for the pre-1935 ("pre-union") period, the post-1935 ("union") period, as well as for the entire period for which data were available. In this way the absolute change in the average labor share and the relative change in the slope of the regression line between the two periods, as well as the slope of the overall regression line, could be calculated for each industry.

In this 36-industry set intra-industry comparisons of the "pre-union" trend line with the "union" trend line revealed that, in general, the post-1935 trend lines either displayed higher average levels and/or had greater relative slopes than the pre-1935 trend lines. This suggests that the post-1935 functional distribution of income within manufacturing industries is, in general, more favorable to labor than the pre-1935 distribution. It does not follow, however, that such favorable-to-labor intra-industry shifts in income distribution are positively correlated with either the average degree of unionization attained in the post-1935 period or changes in the average degree of unionization between the two periods being considered.

In order to determine whether such a correlation exists, a number of different coefficients of rank correlation were computed. The 36 industries were ranked according to the absolute increase in the average degree of unionization between the two periods as well as with respect to the average degree of unionization attained in the post-1935 period considered by itself. The industries were also ranked according to the absolute increase in the average level of the wage-income ratio between the two periods, the relative increase of the slope of the regression line between the two periods, the average rank of the increases in the level-and-slope between the two periods, and the magnitude of the positive slope of the overall regression line. These latter sets of rankings were made first using Census data only, than using Census data combined with Annual Survey data. In this way it was possible to obtain sixteen different coefficients of rank correlation.

In addition, 13 industries for which wage-income ratios could be calculated for the post-1935 period only were ranked according to the magnitude of the positive slope of the post-1935 regression line, first using Census data only and then using Census data together with Annual Survey data. These industries were also ranked according to their respective unionization data in the same manner as has been described for the 36-industry set. In this way it was possible to obtain four additional coefficients of rank correlation.

In none of the twenty cases was the magnitude of the rank correlation coefficient statistically significant. In fact, eight coefficients turned out to be negative, ranging in value from -0.0144 to -0.179. The twelve positive coefficients ranged in value from +0.0436 to only +0.309. On the basis of this evidence the research hypothesis was rejected. Microfilm $2.35; Xerox $8.20. 178 pages.

THE UTILIZATION OF REVENUE BONDS AS A MEANS OF FINANCING GOVERNMENT IN THE UNITED STATES

(L. C. Card No. Mic 59-2650)

William J. Thomas, Ph.D.
Michigan State University, 1957

The objectives of this study are to present a comprehensive survey of the characteristics of revenue bonds and to analyze the economic aspects which are peculiar to this type of public credit instrument.

The study of revenue bond financing as a mode of government finance points up the heterogeneous nature of the public credit instruments commonly referred to loosely as "revenue bonds." Consequently this study first defines and delineates public credit instruments so as to avoid the ambiguity connected with the term as it is presently used in public finance literature.

The depression of the 1930's provided the primary stimulus for the growth of revenue bond financing. The federal government, through various work and loan programs, was instrumental in encouraging the use of revenue bond financing. Statutory and constitutional debt restrictions accompanied by public distaste for property taxes have been important factors sustaining the use of revenue bond financing of public enterprises.

Revenue bond defaults occurring during the Great Depression were generally caused by a lessening of demand for the products of the revenue bond financed enterprise. During the period of high level economic activity since 1940 there have occurred few instances of default although bondholders generally have suffered very little loss. In a large portion of the instances involving default or near-default, the issuing political unit has applied tax money, or has used other less conspicuous means of providing aid, in attempting to avert default. Generally, rate covenants that ordinarily accompany revenue bond issues have not provided an effective means of averting default. If the enterprise is not economically sound, the rate covenant remedy seems to afford little protection from financial loss.

There is every indication, that, on the average, the net interest rate on revenue bond issues is somewhat higher than the net interest rate on general obligation bond issues. The advantage of general obligation bond issues, however, is not as great as first appearances may indicate. Adjusting the net interest rates for the negative effect of size and the positive effect of length of maturity tends to reduce the differential that exists in the interest rates of the original data. These same adjustments applied to special assessment bond issues resulted in a higher net interest rate than for either general obligation bond issues or revenue bond issues.

Although the mere financing by means of revenue bonds does not enhance the debt-paying ability of a political unit, the financing by this type of credit instrument does insure a source of revenue with which to retire the outstanding obligation. This self-liquidating nature of revenue bonds combined with the controls which are ordinarily required by the bond underwriter gives this type of public credit instrument a "built-in" safeguard with respect to excessive indebtedness.

The most significant economic implications of revenue bond financing as compared with general obligation bond financing occur with respect to pricing policies, equity considerations in the distribution of payments for the products of public enterprises, resource allocation, and the efficiency of public enterprises. In addition to these aspects which are more or less inherent in the case of revenue bond financing, there exists man-made laws which affect the desirability of this means of public finance. A quantitative evaluation of the merits and demerits of revenue bond financing as compared with general obligation bond financing which is applicable to every set of circumstances is not possible.

Microfilm $4.80; Xerox $16.00. 373 pages.

THE DECLINE OF ARGENTINA'S AGRICULTURAL TRADE: PROBLEMS AND POLICIES, 1929-54

(L. C. Card No. Mic 59-3729)

Harry Raymond Woltman, Ph.D.
Stanford University, 1959

Major changes in Argentina's agricultural trade and in associated government policies during 1929-54 were related to two fundamental problems of the Argentine economy. One problem was that of instability and maladjustment in the foreign trade sector, arising from the breakdown of the system of multilateral trade and payments upon which the development of Argentina's export-dependent economy had been based. The other problem was one of internal economic structure: the inability of the traditional economic organization, in the face of population growth and limited agricultural land, to maintain a volume of trade consistent with its past performance, together with failure to achieve such structural adjustments as might have enabled it either to maintain trade or reduce the need for it.

During 1869-1929, rapidly growing agricultural production and exports, and the country's ability to market grains and livestock products in western Europe and elsewhere on generally favorable terms, serviced the capital investments and financed the imports necessary to sustain Argentina's explosive growth. Continuing and almost

complete domination of export trade by a limited list of agricultural products--both before and after 1929--is taken as evidence of the degree to which Argentina's comparative advantage has resided in agriculture.

After 1929, the malfunctioning of the trading system on which the nation's development was premised resulted in two basically different kinds of policy response. Unfavorable market conditions in the 1930's reversed the hitherto expanding trend of Argentine trade and forced the government to intervene with trade and internal policies here characterized as "defensive." These measures were successful in maintaining internal stability against severe external pressures, but tended to stimulate industry while agriculture stagnated.

During World War II, export surpluses accumulated and desperately needed import goods were unavailable. Government controls over trade and agriculture proliferated, but again farming suffered while industry flourished. Attempts to preserve the traditional economic order became less acceptable as a national policy. When Perón came to power in 1946 with the slogan of "economic independence," he found popular support and a full-blown control system adaptable to more ambitious purposes.

Government efforts to attain these purposes were handicapped by the external dependence they sought to minimize. Favorable terms of trade in 1946-48 were partially cancelled by import shortages. After 1948, the "dollar shortage" and lower export prices complicated the crucial problems raised by sharply declining export volume. Once foreign exchange reserves were exhausted, economic growth ceased because Argentina's post-1948 economy could not command the imports needed to maintain it.

The causes of the postwar export decline were internal. The Perón regime hoped to accelerate both the shifts in economic structure that had begun in the 1930's and the growth of national income. This it attempted to accomplish by squeezing capital from agriculture, through state trading and other means, for investment in industry. The effects of its policies on export production (aggravated by drought) were not unforeseen, but the extreme impact when they finally materialized was apparently unanticipated.

Belated attempts to encourage export production were not notably successful within the confines allowed government policy by internal political and economic conditions it had itself helped to create. The difficulty was increased by population growth and rising consumption. The government proposed a typically radical solution, a plan for completely revamping Argentina's agriculture which, also typically, it could not implement. In 1951-54, accumulated limitations upon export-generating capacity presented themselves for the first time as Argentina's major economic problem.

Microfilm $4.30; Xerox $14.40. 334 pages.

ECONOMICS, AGRICULTURAL

A STUDY OF THE SWEET CORN INDUSTRY IN THE MIDWEST FARM ECONOMY

(L. C. Card No. Mic 59-3732)

Richard A. Andrews, Ph.D.
University of Minnesota, 1959

This study appraises the prospective position of the sweet corn industry in the Midwest farm economy. Historical developments and economic relationships are analyzed. Because production for processing is more important than production for fresh market in the Midwest, the study is primarily concerned with sweet corn production for processing.

Change is the rule rather than the exception. In the last three decades, the type of canned product demanded shifted from a white cream style type to a golden whole kernel type; new high yielding varieties were developed; freezing techniques were developed and improved; canned sweet corn on the cob was developed only to be replaced by the frozen styles; and major shifts in production areas of sweet corn for processing occurred.

A change in the type of finished product processed is likely to occur in the next decade. The effect on demand for all processed sweet corn in the United States, on the other hand, is likely to be negligible with the new type of processed sweet corn substituted for some other older item. The analysis indicated that the increasing demand for canned sweet corn experienced in the past three decades was associated with a rising real income, increasing consumption of all processed vegetables, and an increasing population. Projections indicate a 20 to 40 percent rise in the United States demand in the decade ahead.

Sweet Corn Supply in the Midwest

Output of sweet corn for processing in the Midwest appears very responsive to price change. A one percent change in price is estimated to be associated with a two to four percent change in quantity offered. Increased Midwest output appears possible with but little increase in price.

Historically, improved technologies have increased supply in Wisconsin and Minnesota. The shift in supply in these two leading producing states indicates a possibility of increased output with no increase in price.

Important in the potential output picture is the comparative advantage Wisconsin and Minnesota have over other Midwest states. The rise in importance of Wisconsin and Minnesota and the fall in importance of Ohio, Indiana and Iowa are attributable to this advantage.

Competition With Other Production Regions

The Midwest states have maintained a fairly stable share of around 70 percent in the United States processed sweet corn market. A spectacular rise in Western production in the past two decades was offset by a decline of Eastern producers market share. The Midwest maintained its position in the United States market through capturing the East's share of an expanding demand. The Midwest appears in a position to continue to capture the East's share in an expanding demand.

Role and Position of the Processor in Prospective Developments

The processor's key role in the processing of sweet corn is essentially integrating two markets, the raw product market and the finished product market; bringing these two markets into harmony. Usually, processors place major emphasis on their finished product marketing activities, and modify their raw product market activities accordingly. Where the processor is the single buyer or one of a few buyers in the processor-grower market, the processor procurement policies are modified chiefly by farmers' crop alternatives.

Farmer-Grower Share in Prospective Developments

How the farmer will fare in prospective developments is of major importance to him. In the first place, a large portion of the increase in demand for raw product may be satisfied from increases in per acre yield. Yield in the post-World War II years increased by about 30 percent.

The second factor determining how the farmer will fare in prospective demand is how much sweet corn for processing will be produced with processor's resources. This will be determined by the relationship between farmer procurement cost and processor production cost.

Microfilm $3.90; Xerox $13.20. 301 pages.

UNITED STATES WHEAT SURPLUSES AND THE ROLE OF THE FARMER ORGANIZATIONS IN THEIR UTILIZATION

(L. C. Card No. Mic 59-2977)

Gangadhar S. Kori, Ph.D.
South Dakota State College, 1959

Supervisor: Associate Professor Ragnar L. Kristjanson

Two problems, (1) the presence of agricultural surpluses causing one of the major socio-economic and political problems in countries such as United States, and (2) the insufficient economic growth of the underdeveloped countries for want of enough food and fiber, have remained unsolved when approached separately. A different coordinated approach, aimed at solving these two problems simultaneously might help to solve both.

The objectives of the thesis were to: (1) Determine the causes, size and composition of the present wheat surpluses in the United States, including the outlook for the next few years, and to evaluate the current farm programs and the suggested approaches toward solving the agricultural surplus problem in general. (2) Determine whether or not a different approach, involving the use of United States wheat surpluses to help finance economic development in underdeveloped countries, may be devised which is not in conflict with the basic policies and current activities of the major farm organizations and what roles the major farm organizations could play in the formulation of such a farm program.

Overproduction has been a recurring problem for the wheat industry for the last 30 years except during the years of 1935-1937 and 1946-1948. The foundation for increased wheat production includes the trend in wheat acreage, progress in farm mechanization and the trends toward scientific agriculture. Although the acreage of wheat seeded has been characterized by wide fluctuations, the current trend is toward reduction in wheat acreage through acreage allotment program.

Until 1950, farm mechanization was an important factor in increasing the efficiency of wheat production. But in the 1950's the upward trend in wheat yield per acre due to widespread adoption of scientific methods seems to be one of the primary factors which may lead to overproduction of wheat in future years.

In attempting to solve the wheat surplus problem and the farmer's income problem various solutions have been suggested. The suggestions fall into two categories. They are adjustments in wheat production and adjustments in the demand for wheat.

Under the present circumstances it is highly questionable whether or not any of the production control measures, acceptable to our society, would control the productive capacity of the efficient "agricultural plant" of the United States.

On the basis of available evidence it seems unlikely there will be any material change in the total quantity of wheat used for food, feed, seed and industrial purpose in the United States. Prospects of increasing wheat exports for dollars do not seem to be bright because of the overall shortage of dollar exchange of major wheat importing countries. There are strong indications that the future wheat supplies are above the future requirements and the wheat surplus situation is likely to continue for at least some years.

However, use of agricultural surpluses for economic development purposes seems to have possibilities. On the one hand the United States may be able to utilize its surpluses and on the other hand the underdeveloped countries may be enabled to continue and enlarge their economic development activities.

The United States during the past four years, under the Agricultural Trade Development and Assistance Act of 1954 (Public Law 480), exported some agricultural surpluses for economic development purposes.

In order to improve and expand the use of agricultural surpluses for economic development, there is immediate need for additional knowledge in the methods of handling the transactions, administrative and financial techniques, and the effects upon the underdeveloped countries, including the effects on international trade. One of the ways to gain the needed knowledge is to undertake research studies.

In solving problems in the areas mentioned above, major farm organizations have a vital role to play. The idea of using agricultural surpluses for economic development does not seem to be in conflict with the basic policies of the three major farm organizations - The American Farm Bureau Federation, the National Farmers Union and the Grange. In order to play their roles effectively, major farm organizations need to iron out their minor differences and take a common stand in formulating policies concerning agricultural surplus utilization programs.

Among other things, unity among major farm organizations would greatly help the administrators and the politicians alike to take bold imaginative steps to use agricultural surpluses for economic development purposes.

Microfilm $2.15; Xerox $7.60. 164 pages.

ECONOMICS, COMMERCE – BUSINESS

MANAGERIAL DECISION MAKING IN THE SMALL FIRM: A CONSIDERATION OF SOME PROBLEMS AND APPROACHES IN A RETAIL SETTING

(L. C. Card No. Mic 59-3912)

Earl Dean Bennett, Ph.D.
University of Michigan, 1959

Small business has become an important issue in the controversy over the distribution of economic power. Studies reflect divergent points of view as to the significance of small firms, their needs for survival, and the effectiveness of various forms of governmental and private assistance programs.

This study examines critical aspects of small-scale retail operations which seem related to the success or failure of the firm. The objectives are to (a) develop a meaningful framework for thinking about the role of small retail firms and the management problems of their owners, and (b) provide the bases for evaluating the effectiveness of assistance measures. The study centers on the problems and approaches of the owner-manager in the discharge of his entrepreneurial responsibilities.

The data were drawn from a wide variety of sources and include management and operating characteristics of about 250 small retail firms. Specifically, the approaches and sequential developments are:

(1) A review of studies of small business points up major areas of conflict and confusion over the role and problems of small firms. An analysis of census data shows that small firms predominate in all aspects of business population movements. These findings point up a number of the challenges managers must face incident to the genesis and longevity of small business firms.

(2) An appraisal of chain store tax and fair trade legislation, against a background of retail census and other statistical data, suggests that these measures tend to treat symptoms rather than basic causes of the problems of small retail firms.

(3) A summary of nine mortality studies highlights the managerial and environmental characteristics of businesses that have failed or been discontinued. Most of these studies indicated that the important factors related to business longevity were subject to management control.

(4) A quantitative analysis of survey data for successful, or at least surviving, small retail firms reveals the presence of the same factors that were commonly associated with failures and discontinuances.

(5) An examination of trade association responses to mail questionnaires provides additional insight into the managerial problems and needs of small retail firms. Furthermore, the association responses provide a description of management assistance programs. Effective utilization of programs depends upon the associations' educational efforts and contacts at local levels and upon the aggressiveness of owner-managers.

(6) A qualitative analysis of decision-making concepts applied to case studies tests prior observations and develops guide lines for evaluating managerial assistance programs. The findings indicate substantial differences in the decision-making process between small and large firms. Small firms characteristics create a greater need for self-initiated decisions than for approval of subordinates' recommendations, and lead to owner-manager involvement in the formulation and activation of decisions. This places a premium on the self-development of technical, human, and conceptual skills.

Some conclusions of this investigation are:

(1) Most small retail firms simply provide a means of satisfying the wants of individuals as consumers and entrepreneurs.

(2) There is little promise of strengthening their competitive positions through legislation.

(3) Trade associations can contribute more to the economic well-being of small businesses through management training than through legislative activities.

(4) While individuals continue to assume managerial responsibilities for which they are ill-equipped, their success or failure in the small firm depends not so much on what they bring to the enterprise but on how they develop and/or supplement their management skills in the process of decision making.

The over-all results point to the need for a better understanding of ways to foster the development of managerial skills--particularly human and conceptual--within the framework of the small firm. Herein lies the real challenge for future research and the greatest promise for increasing management effectiveness and for improving the competitive position of the small firms.

Microfilm $4.55; Xerox $15.20. 355 pages.

VARYING CONCEPTS OF ACCOUNTING FOR OWNERSHIP EQUITY IN CALIFORNIA CORPORATIONS

(L. C. Card No. Mic 59-3685)

Harry Raymond Buttimer, Jr., Ph.D.
Stanford University, 1959

This dissertation is primarily a comparison of those accounting provisions of the California Corporations Code which affect shareholders' equity with the applicable currently acceptable accounting standards. Despite cooperative efforts of accountants and attorneys, there remains a wide divergence of opinion on the matter of properly accounting for corporate net worth. The purposes of this study are: (1) to develop logical accouting procedures for the presentation of financial statements in compliance with California law; (2) to direct attention to those provisions of the California Corporations Code which are unreasonable and inconsistent; (3) to make specific recommendations for legislative clarification and revision of the statute.

The major areas explored include the stated capital concept, the origin, classification and nature of surplus accounts, treasury stock transactions, and the limitations imposed on dividend distributions. These problems are discussed within the framework of a single corporation, so that issues arising from parent-subsidiary relationships are excluded from the study.

Legal concepts of corporate net worth were garnered from the California Corporations Code, statutory requirements in other states, the Model Business Corporation Act prepared by the Committee on Corporate Laws of the American Bar Association, cases, law textbooks and periodicals, and the accounting releases of the Securities and Exchange Commission. The staff of the California Corporation Commissioner furnished information on matters of statutory interpretations of accounting provisions as experienced in

its dealings with California corporations. The position of accounting was determined through reference to the monographs and other publications of the American Institute of Certified Public Accountants and the American Accounting Association, writings of accounting authorities in the contemporary literature, and stockholders' reports.

The results of the study show that accounting and the law are not in full accord on the problem of accounting for shareholders' equity. "Stated capital" has replaced "Capital stock" in the California law, but the two are not synonymous. Accountants continue to think in terms of "Capital stock," while analysis shows that "Stated capital" is not indicative of shares of stock (authorized, issues or outstanding). The modern concept of stated capital is that of a legal limitation on stockholder withdrawals, and its amount is not necessarily related to specific shares of stock or their aggregate par or stated value.

Statutory restrictions on treasury stock purchases do not parallel the recommended accounting procedures for such transactions. Use of a "Treasury stock" account seems undesirable in California, since the law ordinarily treats the cost of reacquired shares as a permanent reduction in "Retained earnings." Treasury stock acquisitions and subsequent share retirements or reissues are completely dissociated events under the law. Treasury share retirements do not require an accounting entry, unless the corporate board of directors elects to reduce stated capital and establish a "reduction surplus." The entire proceeds of treasury share resales are credited to paid-in surplus, unless the company has a deficit. Regardless of the manner of disposition of treasury shares, "Retained earnings" stands diminished by the cost of acquisition.

The California Corporations Code does not specify the sequences in which corporate net worth accounts should be charged for dividends, while accountants would generally insist upon the exhaustion of retained earnings before charging another capital account. Also, the various surplus accounts have different meanings in the law from those in accounting.

The general conclusions reached are: (1) accountants should recognize the stated capital concept and present financial statements accordingly; (2) draftsmen of corporate laws should give more consideration to accounting principles, as was done in the revision of the British Companies Act; (3) the California Corporations Code needs considerable clarification and revision to eliminate inconsistencies and illogical provisions.

Microfilm $3.40; Xerox $11.60. 264 pages.

PROBLEMS ENCOUNTERED BY NEGRO MANAGERS IN THE OPERATION OF BUSINESS ESTABLISHMENTS IN NASHVILLE, TENNESSEE

(L. C. Card No. Mic 59-4275)

Cecille Evans Crump, Ed.D.
Indiana University, 1959

Chairman: Elvin S. Eyster

The Problem

The problem was a study of difficulties and problems encountered by Negro managers in the operation of business establishments in Nashville, Tennessee, in the following areas of management: physical facilities, personnel, finance, record keeping, and merchandising (buying and selling).

Procedure

Problems encountered by the Negro managers were deduced by analyzing the difficulties which confronted them in planning, directing, and controlling their business operations.

First, a survey of literature was made to determine the nature and scope of previous investigations related to the problem and to discover historical aspects of Negro business.

Next, a survey of business establishments in Nashville which are managed by Negroes was conducted so that the number and kinds of business activity engaged in by these businessmen could be identified and managers could be selected to be interviewed.

After 100 managers were selected, the interview-observation technique was employed to determine difficulties which confronted the managers. From an analysis of their difficulties, problems were deduced.

Finally, a survey of literature concerning agencies and institutions which have planned programs to assist business managers with their problems was conducted to obtain sources and nature of management guidance services. Data collected during the interviews and from the literature were analyzed to reveal the needs of businessmen for assistance with their managerial problems.

Summary

The survey of business establishments managed by Negroes revealed that they managed 290 enterprises representing a variety of types of business activity. Difficulties were experienced by the 100 selected managers in establishing techniques and procedures necessary for the performance of their business activities. Thirty-three general problems were discovered in the following areas of management: physical facilities, personnel, financial management, record keeping, and merchandising (buying and selling). These problems indicated ineffective management procedures which deterred the success of the establishments.

Although about an equal number of problems was discovered in all functions of management, the area in which the managers experienced most of their difficulties was in merchandising. The extent of the difficulties which they encountered in other areas could have been offset had the techniques and procedures employed by the managers in buying and selling been more effective. Their selling efforts were further impeded because of the serious personnel problems which confronted them.

The nature of the problems encountered by the managers and the personal data concerning their background, preparation, and continuous training for the role of management led to the following inferences: (1) the restricted economy in which the managers operate affected their business practices; (2) the managers had not been trained for managerial responsibilities; (3) the managers did not recognize the need for continuous professional development; (4) the managers did not understand the nature of competition in a capitalistic society; (5) the financial base

of the organizations hampered the successful operation of the establishments; and (6) the managers did not recognize the need for seeking competent guidance in discovering and solving their problems.

Educational Implications

Educational institutions are in a position to assist Negro managers in improving their business establishments. They should reorganize their curriculums to meet the needs of business; assume leadership in working with community forces to eliminate barriers which obstruct the progress of Negro entrepreneurs; offer in-service training for managers; promote trade associations; prepare specific materials; conduct research which would assist Negro managers in understanding their actual and potential markets; and coordinate guidance services which are extended by government agencies, business firms, and trade associations.

Microfilm $3.80; Xerox $12.80. 293 pages.

AN INQUIRY INTO A THEORY OF BUDGETING

(L. C. Card No. Mic 59-3692)

Gordon Bitter Davis, Ph.D.
Stanford University, 1959

Much has been written to explain how to budget; little has been written to explain the concepts or ideas which underlie budgeting practices. Theoretical expositions have been written in related fields such as accounting; this is an exploratory study in the area of budgeting. The thesis is written primarily in terms of business budgeting, but the basic similarities between different budgeting systems make many of the concepts equally applicable to government and family budgeting.

The dissertation has essentially three parts: the first is an historical overview of the development of budgeting; the second is a theoretical explanation of budgeting; and the third is a discussion of the relationship of budgeting to management, accounting, and forecasting and a discussion of the differences in budgeting by business, by government, and by families.

Budgeting practices are analyzed and related knowledge and ideas are explored. An interrelated set of concepts which account for the practices of budgeting are formulated. The elements of the theoretical explanation are the basis and purpose of budgeting and six basic concepts: the budgeting entity, budgeting data, budgeting cost, the budgeting period, evaluative measurement, and reporting.

Budgeting is conceived of as an aid to the management process. It is a means used by management to plan, coordinate, and control the time and resources expended in attaining the objectives of an organization. In the organismic approach to organization and management, budgeting is a useful aid by which management may maintain homeostasis. The use of a budget improves and extends the ability of management to carry out its functions of planning, coordination, and control. The budgeting process assists management by quantifying expectations, by compressing them into meaningful categories, and by programming them into consistent models. The process allows management to handle large amounts of information, and the results of the process provide standards by which management can evaluate and direct performance.

Some of the concepts that are described are generally understood, but have been unexpressed; these are set forth in writing. Some were obscure; an attempt is made to clarify them. Some have not previously been considered; these are formulated. The resulting conceptual description of budgeting and its relationship to other knowledge is useful as a guide to thinking, to discussion, to practice, and to an understanding of the art of budgeting.

Microfilm $2.55; Xerox $8.80. 194 pages.

EFFECT OF REGULATION UNDER ALTERNATE RATE BASE TYPES UPON TELEPHONE AND ELECTRIC UTILITY EARNINGS

(L. C. Card No. Mic 59-4792)

David Kurt Eiteman, Ph.D.
Northwestern University, 1959

This is an analysis of the effect of the adoption of particular rate base types by state regulatory commissions upon the earnings of two sets of companies: fifteen Bell telephone single-state operating companies, and 108 Class A and B electric utilities in twenty-three selected jurisdictions.

General rate cases applicable to these companies which occurred between January, 1944, the date of the Hope Case (320 U.S. 591), and December, 1957, are analyzed to determine jurisdiction regulatory practice. Earnings data for the 1948-1957 decade are evaluated against this regulatory background.

State commissions typically allow utilities a percentage rate of return upon a rate base purporting to measure the value of the assets used or useful in serving the public. Methods of valuing assets, with minor exceptions, are of three general types: (1) valuation based upon net original cost, (2) valuation based upon net reproduction cost, and (3) valuation established with reference to both net original cost and net reproduction cost, and often (although not always) located between the two. This latter type of base is frequently referred to as "fair value"; however, the meaning of this term varies from jurisdiction to jurisdiction. In this paper, "fair value" is used to describe only those rate bases with a dollar amount between net original cost and net reproduction cost. (If a commission finds "fair value" to be equal to net original cost, this rate base is classified as "net original cost," not as "fair value.")

Analysis of permitted rates of return (percentage returns formally granted by commissions) in telephone decisions indicates a tendency for permitted returns in original cost decisions to be highest, permitted returns in fair value decisions to be next highest, and permitted returns in reproduction cost decisions to be lowest. This is evidence of commissions' tendencies to offset use of relatively low rate bases with higher permitted rates of return, and vice versa.

There is no evidence of similar offsetting in the electric decisions studied.

Reproduction cost relative to original cost tends to be higher for telephone companies than for electric companies, probably because of the greater average age of electric assets. However, fair value findings in both telephone

and electric decisions average approximately the same percentage above net original cost, with the result that the average relative weight given reproduction cost in determining fair value is greater in telephone decisions than in electric decisions.

If the permitted returns in fair value and reproduction cost decisions are converted into the equivalent returns which would have had to be granted upon net original cost in order to allow identical dollar earnings, the converted equivalent returns are substantially higher as a group than the returns typically permitted in original cost decisions.

Comparison of actual rates of earnings of utilities by rate base groupings indicates, as would be expected, that reproduction cost utilities tend to average the highest earnings, fair value utilities an intermediate level of earnings, and original cost utilities the lowest earnings. A wide variability exists among individual companies within rate base groups, however. Many original cost utilities have relatively high earnings, and some fair value and reproduction cost utilities have relatively low earnings. Commissions which profess to use the same rate base method do not consistently achieve similar results.

During the 1948-1957 decade, the margin between average rates of earnings for fair value and original cost utilities increased for telephone companies but decreased for electric utilities. Average margins between rate base groups for the decade as a whole were quite similar to the margins indicated in the comparison of equivalent permitted returns on original cost derived from regulatory decisions. Microfilm $4.80; Xerox $16.00. 375 pages.

THE IMPACT OF ELECTRONIC COMPUTERS ON MANAGEMENT PROCESSES: CASE STUDIES IN THREE LEADING COMPANIES

(L. C. Card No. Mic 59-4066)

James Barber Foxworth, Ph.D.
Columbia University, 1959

This study is directed at the management implications of the use of electronic computers, in terms of the impact that such use has had on the administrative processes of organization planning and control.

The literature in this field is divided roughly into two conflicting groups. One group predicts that computers will have a revolutionary impact on management. The other says computers are simply a better way of doing what is already being done. The chief defect in both of these groups is the lack of a means for assessing its validity, since the conclusions expressed are generally not accompanied by the evidence upon which they are based.

This study is directed in part at that defect, in that it is a report on the progress that has been made in the use of computers by three companies that are leaders in such use. It includes detailed descriptions of what has happened in these companies, and an analysis of the significance of these results.

The report is deliberately biased toward the greatest progress in the use of computers, and the selection of companies to be studied was made with this in mind. From a preliminary study of fifteen leading companies that appeared to have made the most progress, the three were selected for more detailed study.

In these three companies the study was directed at an analysis of administrative processes before and after computers were installed, to determine the changes that had occurred. Major reliance was placed on interviews, not with the people who operate the computers, but with the members of management who use the results.

The report includes detailed analyses of applications in three areas. The first is a group of technical applications in which a variety of mathematical and statistical techniques are used to assist in decision making. The second is a data processing application (inventory control) that is illustrative of a group involving automatic decision making. The third is an analysis of efforts to achieve an integrated data processing installation.

This specific analysis is followed by an overall analysis of the impact of computers on management processes, first in terms of the significance of what has already happened and then in terms of implications for the foreseeable future. Finally, a tentative effort is made to explore the administrative factors that seem to facilitate success in computer installations.

Probably the most important conclusion reached is that computers have not had a revolutionary impact on management processes. Further, there is nothing in what has already happened to indicate that a revolution is likely in the foreseeable future.

Nevertheless, there have been some substantial accomplishments with the help of computers. It has been demonstrated that computers can handle large complex data processing problems quickly, accurately, and economically. More important, a large industrial company that succeeds in integrating on computers an effective data processing system stands to gain, in increased flexibility and decreased lead time, a substantial competitive advantage.

Among the administrative factors that seemed to facilitate success in computer installations were an administrative atmosphere conducive to desirable change, organizational independence for computer personnel to allow greater freedom for development, active participation (even initiative) by operating personnel, and a smoothly functioning system to serve as a base.

Microfilm $4.00; Xerox $13.40. 310 pages.

TRADE-IN HOUSING PROGRAMS: AN ANALYTICAL APPRAISAL AND EVALUATION

(L. C. Card No. Mic 59-3708)

John Milton Hess, Ph.D.
Stanford University, 1959

Trade-in housing plans and programs permit homeowners to trade their equity in one house for an equity in another. Such programs are based on widespread home ownership, mass-produced and mass-marketed houses, and favorable real estate financing conditions. The growth of house trading has been retarded by the industry's lack of information; therefore, this study attempts to determine whether trade-in housing programs are workable and to discover the most favorable operating arrangements and conditions for such programs. It attempts to determine whether trade-in plans are profitable for builders and realtors, and beneficial for homeowners; and whether trading will be accepted by those groups.

Five sources of original information covering both the trade and homeowners constitute the primary basis for this study. They are 1) The author's interviews with over one hundred and twenty traders, non-trading builders and realtors, government and trade association officials, and representatives of lending institutions which are active in housing finance. 2) Two hundred and forty-nine brief, completed questionnaires from trading and non-trading builders and realtors. 3) One hundred and one comprehensive (120 items of information), completed questionnaires, from active trading firms. 4) One hundred and five completed questionnaires (including the results of 61 personal interviews) from families which had actually traded in a house in 1956 or 1957. 5) Four hundred and forty-one completed questionnaires (including the results of 281 personal interviews) from an income-stratified, random sample of the homeowners in Redwood City, California.

This study traces the development of trade-in housing programs and attempts to appraise the factors relating to the possible future volume of trade-in transactions. The analysis and appraisal of the operation of trade-in housing programs is organized around three areas.

The first section relates to basic management activities. It identifies and analyzes three major types of trade-in plans and their variations, and differentiates between trading and other methods of transferring home ownership. The operation of each type of plan is considered, as are the advantages and disadvantages of each plan. Various organizational arrangements for trading and the risk and profitability of trading are next considered.

The second section deals with the marketing problems surrounding trade-ins. It provides an analysis of the current market for trade-ins. Attention is given to special problems encountered in advertising trade-ins, preparation of the selling force so that it can handle trade-in sales competently, and the problems and techniques directly related to the actual selling situation.

The third major section discusses the problems of appraising, pricing, financing and selling the used houses taken in trade.

Trade-in housing programs are workable and can be profitably employed by realty and building firms of almost any size. In most instances, large volume trading firms appear to have several operating advantages over small firms. All three major trade-in plans are needed in certain circumstances, but, in general, the guarantee plan offers more benefits to traders than the other plans. Trade-in programs are potentially important in selling both new and used houses, but are not so sufficiently widespread that one can readily estimate their economic importance or implications. Their growth depends on their acceptance by homeowners, builders and realtors. Because all three groups appear to have much to gain from house trading, this activity is likely to grow in importance.

Microfilm $6.05; Xerox $21.00. 474 pages.

ELECTRIC POWER SUPPLY AND NATIONAL SECURITY: A STUDY IN PUBLIC POLICY

(L. C. Card No. Mic 59-4076)

Benjamin S. Loeb, Ph.D.
Columbia University, 1959

This study concerns the adequacy of electric power supply for national security.

Part I deals with the problem historically. In World War I power shortages caught the country by surprise. Their causes and remedial measures attempted are analyzed.

Factors making for an improved situation during World War II are reviewed. While an initial high reserve is found to have been very helpful, much credit is also given to the War Production Board's power group for energetic and imaginative actions to increase power supply and hold down power demands.

Power shortages following World War II are found to have resulted largely from economic miscalculation and conservative practices of utility enterprises.

A decision to conduct mobilization during the Korean War on a "guns and butter too" basis led to a protracted controversy as to the proper amount of power expansion. Once an expansion program was formally established, it was not fully effectuated and the reasons for this are examined. Sections are devoted to the controversy about extending accelerated amortization privileges to utilities and to the Pacific Northwest power shortage of 1952-53.

Since the Korean War, some progress has been made in studying regional wartime power needs, in establishing emergency organizations to administer power matters following an attack, and in training utility personnel through civil defense exercises. It is contended, however, that measures taken do not meet the need and have been taken too slowly, that staffs working on the problem are too small, and that the approach to it is unimaginative and unduly influenced by peacetime economic considerations.

Part II is devoted to an effort to establish certain guiding facts and principles which can serve as reasonable bases for defense power planning under modern conditions. The extraordinary degree of dependence on electricity for the processes of life in our society and the difficulties that would be faced by administrators in dealing with severe wartime power shortages are shown. It is next indicated that the reserves of generating capacity normally carried by utility enterprises are intended to provide only for contingencies reasonably likely to occur under peacetime conditions, not for the incremental hazards of war.

The nature of those incremental hazards is then examined. Despite greater readiness required for nuclear war, it is found that, as in past wars, electricity may in future wars be required to accelerate production. A more imperious need may be for survival of populations and recovery of communities following a nuclear attack. On the supply side, it is indicated that power availability may be reduced in wartime by saturation or pinpoint attacks, or by sabotage.

Part III examines certain measures which might improve our readiness position. Careful study of these actions by cognizant government agencies is urged. They include construction of additional and stronger transmission lines, the hardening of generating plants through protective construction and anti-sabotage features, reversal

of the trend toward concentration of generating capacity in larger and larger plants, the construction of underground power plants and mobile power plants, and the addition during peacetime on an extra reserve of power capacity to provide for the additional hazards of war. Ways of financing such measures are considered. It is argued that, since the principal benefit is to national security, the incremental costs beyond what would normally be incurred are a proper charge to the entire nation, hence to the Federal Government.

Failure to take some of these actions or even to study them seriously is attributed to the fact that they are uneconomic by normal peacetime standards. A plea is made for recognition of the preeminence of security needs over the inhibiting economic values.

Microfilm $2.80; Xerox $9.80. 216 pages.

THE IMPACT OF THE ST. LAWRENCE SEAWAY UPON THE ECONOMY OF VIRGINIA

(L. C. Card No. Mic 59-4241)

George Charles Nichols, Ph.D.
University of Virginia, 1959

The purpose of this study is to determine with reasonable accuracy the nature and extent of potential traffic diversion from Virginia to Seaway ports after the completion of the Seaway project in the Spring of 1959. After giving a brief historical background of the project, the study examines the problem of setting a satisfactory level of tolls in the light of what seem to be contradictory provisions in Public Law 358. It is concluded that the newly-proposed rates are not sufficiently high to make the Seaway self-supporting.

Since the level of tolls alone will not determine the volume of potential diversion, the study next examines the nature and extent of competition between the Virginia and Seaway ports. For this purpose the flow of the overseas trade of the two areas is analyzed on a commodity-by-commodity basis and by port of lading (for exports) and of unlading (for imports). To examine the degree or intensity of competition between the two sets of ports for each commodity, the flow of their overseas trade is analyzed in terms of (a) competitive potentially competitive, and non-competitive commodities according to whether, in the current period, the commodities move by way of both Seaway and Virginia ports, Virginia ports exclusively, or Seaway ports exclusively; and (b) a competitive and a non-competitive (or less competitive) area, the first covering all European countries outside the Soviet bloc and countries around the Mediterranean Basin, the second all other countries in the world. Thus, competitive and potentially competitive commodities, in this order, moving to and from the competitive area abroad are the most likely to be diverted to Seaway ports.

The area of competitiveness of the two sets of ports is further narrowed down by analyzing the importance and magnitude of Virginia's overseas trade originating in or destined to points located in the state's hinterland. The latter is subdivided into three large territories -- Captive, Differential, and Competitive -- according to the prevailing rail rates. Commodities to and from the Differential Territory are regarded as potentially the most vulnerable from the point of view of diversion; hence trade between Hampton Roads and this Territory is analyzed in detail.

Finally, on the basis of the data thus derived, the study determines the extent of potential diversion by examining separately each of the 120 commodities found to be competitive or potentially competitive. Various individual factors are taken into account in estimating the potential diversion of each commodity; particular emphasis is given to the through cost (ocean plus rail) of shipping each commodity (or a suitable substitute thereof) to and from the countries of origin or destination in the competitive area abroad to and from representative inland points in the Differential Territory by way of Hampton Roads and the Seaway ports. In the case of the latter ports the appropriate amount of tolls is added to the ocean-rail cost. The potential diversion of each commodity is expressed as an annual average during 1959-1963 in the light of prospective economic growth in the state of Virginia and the Hampton Roads area.

The study concludes that the total potential diversion to Seaway ports during 1959-1963 will average around 605,269 tons annually of which 50,032 tons will be imports and 555,237 tons exports. This volume of potential diversion is only 0.74 percent of the entire potential (i.e. before deduction of diversion) traffic during the same period. Several specific recommendations are suggested to create new traffic for the ports of Virginia.

Microfilm $7.65; Xerox $26.20. 603 pages.

QUALITY CONTROL: A STUDY OF ITS USES AND TECHNIQUES IN OFFICE MANAGEMENT

(L. C. Card No. Mic 59-3814)

George C. Potter, Ph.D.
State University of Iowa, 1959

Chairman: Professor Cleo P. Casady

The major purpose of this study was to identify and interpret the nature of quality control as it is applicable to office work, in order to determine the means by which the functions of quality control may be utilized in office management.

The basic source of data for the study has been library and other published materials. Library card catalogs, special bibliographies, and periodical indexes served as the primary sources of references. References included office managements and statistics books, periodicals, government documents, publications of institutions and professional societies, annuals, and ephemeral materials. Supplementary data was obtained through personal visitations to firms where office quality control programs were installed, interviews with management consultants, correspondence to clarify points not clear in the original published material, visitations to industrial plants, and experience in the installation of a statistically quality control program in a small factory.

The results of the study reveal that the most significant developments in quality control programs in the office have occurred where statistical techniques have been utilized. The introduction of statistical quality control in offices is comparatively recent.

Office quality control programs encompass a wide area of different clerical activities. Those firms with programs are in substantial agreement that the proven benefits include (1) an improvement in the quality of office work, (2) a decrease in the number of errors, (3) a reduction in office costs, (4) a curtailment in the required amount of verification, and (5) the development of quality consciousness on the part of the employees.

Quality control is the systematic effort that is put forth to discover the causes of clerical errors and the steps that are taken to eliminate or to reduce them. Thus, quality is affected favorably through over-all control of office production. Work measurement, work simplification, and many other office managerial functions may be utilized to smooth the work process. The development of quality standards is an essential part of a quality control program. The functions of measurement, standards, and control are interrelated. The extent to which these and other scientific office management techniques are applied is the determining factor in the success of quality control programs.

The techniques of any specific control plan, such as the availability of standards, the use of sampling, and the selection of control devices, will vary with the needs and character of the individual operation. The suggested steps for the installation of a program are included in the study.

The function and role of quality and quality control has not been clearly defined. Only recently has there been specific attention to quality. Research indicates that quality control was not separately identified in the office until the introduction of statistical quality control into the offices. The reason for the limited use of statistical quality control in the office field is not from the lack of possible applications, but, principally, because of the lack of understanding of statistical quality control by those individuals responsible for performing or planning clerical operations.

Recommended for quality control programs in offices is a combined training program with work experience for office employees to develop quality-mindedness and a better understanding of the possible applications of quality control techniques in office operations. Recommended for office management classes is an emphasis on the development of an understanding that many of the elements of scientific office management have an important relationship to the completion of work of high quality.

Microfilm $4.70; Xerox $15.80. 368 pages.

SOVIET FOREIGN TRADE ORGANIZATION AND OPERATIONS

(L. C. Card No. Mic 59-3722)

Glen Alden Smith, Ph.D.
Stanford University, 1959

This dissertation studies Soviet foreign trade policy, organization, finance, and promotion, and Soviet trade with specific areas.

The discussion of policy covers the development of and reasons for such policies as the monopoly of foreign trade, autarchy, the export and import policies, tariffs, and relations with other countries. The reasons for Soviet dumping are discussed, and post-World War II policies are described. A brief reference to the possibility of comparative advantage as a Soviet policy concludes this section.

The topic of organization is discussed in four chapters. The first of these chapters discusses the development of the organizations in foreign trade operations during various periods of Soviet history and considers the reasons for each of the various changes. During the New Economic Policy period, these organizations included mixed companies, cooperative organizations, Soviet companies abroad, trusts, syndicates, and corporations. During the period of the five-year plans, these operations were consolidated in monopoly foreign trade corporations. Following World War II, these monopoly foreign trade corporations remained predominant, but in the bloc countries new forms of mixed companies and Soviet companies abroad were developed by the Soviet Union on the basis of war reparations. The next chapter discusses the development and nature of the foreign trade control organizations from the Foreign Trade Council of 1918 to the Ministry of Foreign trade of 1959. To add clarity to the discussion of various organizations, the author has prepared a series of organizational charts for both the foreign trade operations and the foreign trade control organizations. Organizational topics are also discussed in the chapters on foreign trade finance and promotion.

In addition to such organizations as the State Bank, the Foreign Trade Bank, the All-Cooperative Bank, the Bank for Russian Trade, and a Soviet bloc bank, the chapter on finance discusses Soviet money and its relationship to foreign trade and the importance of foreign credits in Soviet trade. Likewise, in addition to the development of the Chambers of Commerce and various auxiliary trade promotion organizations, the chapter on promotion discusses such topics as trade fairs, trade promotion conferences, and visits of trade delegations and dignitaries.

The analysis of Soviet trade with specific areas covers such trade with the countries of the East (1918-1939), the People's Democracies, and the underdeveloped countries. The topic of trade with the East is divided into two sections -- trade with the independent countries of the East and trade with the People's Soviet Republics. The discussion of trade with the People's Democracies covers the means used to gain control over this trade, the reorganization of foreign trade organizations, and the Council for Economic Mutual Assistance. The analysis of trade with underdeveloped countries indicates that this trade is based on a Soviet economic need for raw materials and foodstuffs and that credits to these countries are for the purpose of obtaining exchange needed to pay for imports.

A brief discussion of Western restrictions on Soviet trade concludes the study. These restrictions included a blockade from 1918 to 1920, anti-dumping laws, war-time embargoes, and post-World War II strategic trade controls.

A forecast of future Soviet foreign trade actions is then made. This forecast includes changes in organizations, finance (including convertibility of the ruble), promotion, and trade with three areas -- the People's Democracies, the countries of the West, and the underdeveloped countries. Following this, the author has suggested various actions to be taken by the West to counter any possible Soviet threat in the fields of foreign trade competition, state trading, and the development of socialism in the underdeveloped countries.

Microfilm $4.65; Xerox $15.60. 362 pages.

AN EVALUATION OF THE CONNECTICUT FOOD AND DRUG COMMISSION WITH SPECIAL REFERENCE TO THE SUPERVISION OF DRUG AND COSMETIC ADVERTISING AND LABELING

(L. C. Card No. Mic 59-4091)

Roland Beatcher Smith, Ph.D.
Columbia University, 1959

Connecticut pure food and drug laws date from the 18th century, although the bulk of the legislation has been enacted since 1886 when a law forbidding the deceptive sale of imitation butter was passed and a dairy commission was established to enforce it. This commission was superseded by the Food and Drug Commission in 1947.

In 1948 an advisory committee, composed of specialists in medicine, pharmacy, chemistry, dentistry, bacteriology, and veterinary medicine, was organized "to supply state agencies...with disinterested opinion" about the "therapeutic status" of products whose effectiveness or safety was questionable. With the occasional aid of consultants, the committee has evaluated products suspected of being in violation of the law, reviewed advertising claims and labels. Acting on its own initiative, the committee proposed and sponsored the Connecticut Hazardous Substance Labeling law.

This law was an outcome of an attempt to prevent injuries and deaths from accidental poisoning, by the compilation of a list of commercial products containing hazardous substances, with their ingredients and recommended antidotes. Out of this came Poison Control Centers. Meanwhile, New York state had enacted a law requiring warning signal words, precautionary instructions, and first aid advice to be part of the label content on products considered dangerous when used in the household, e.g., cleaners, polishes, solvents, and paints. Connecticut followed New York's example with a bill which became effective July 1, 1958.

An attempt was made to sample business attitudes toward this and other legislation affecting Connecticut firms by a survey of producers in the state licensed to manufacture drugs, devices and cosmetics. With few exceptions it was found that business accepts these laws as necessary and their enforcement as desirable. The raising of standards to be met by all competitors, the elimination of "chiselers" as rivals, and the protection of consumers with the consequent increased confidence and inclination to buy, were given as the principal reasons.

As judged by standards of technical competence, objectivity, legality of activity, and efficiency, the commission appears to be an effective agency. By similar standards the advisory committee seems also to merit commendation. However, it is recommended that its judgments about the deceptiveness of advertisements be supplemented by field studies of consumer inferences.

The study suggests that a gap exists between the standards, beliefs, and attitudes of those who sponsor social control legislation and of the general public which is to be benefitted by the legislation. It is therefore recommended that the Governor appoint a study commission to review carefully present legislation affecting business in this state with the view to reconciling the laws and their implications with consumer objectives and the competitive forces which cater to them; and, to plan for whatever future controls that may appear justifiable so that, if enacted, these laws will not become stop-gap legislation, but part of a planned, integrated program. This integration is believed necessary so that the laws, while protecting the public against real dangers, will not also deprive consumers of either the benefits of competition or the responsibility for independence of thought and action--prerequisites to an effective and durable democracy.

Microfilm $4.80; Xerox $16.00. 374 pages.

THE DYNAMICS OF INDUSTRIAL LOCATION

(L. C. Card No. Mic 59-991)

Henry Boyce Wilson, Ph.D.
University of Alabama, 1958

The purpose of this thesis is to proceed historically and analytically to examine the character in general and the dynamics in particular of the major determinants of industrial location.

An examination of economic theories does not yield much that is meaningful in the evaluation of the determinants of the dynamics of industrial location. Likewise, an examination of the changes in the geography of American manufacturing industry from 1899 to 1954 does not yield conclusive evidence as to the causal factors operating during the period.

It has been said that the only thing certain in this world is change. Social scientists set forth as a fundamental principle that the major dynamic force operating to bring change in man's affairs is advancing technology. This principle certainly holds insofar as the determinants of industrial location are concerned.

As the technology relative to energy and transporation has advanced to its present-day state, adequate materials, wide markets, and competent labor have more and more become available to industry in every region and in every state of the United States. In the last 100 years, the advancement of technology has so developed in the United States that the material, physical, and mechanical factors involved have become less and less significant elements in the determination of industrial location. Actually, if material, physical, and mechanical factors were all that are involved, one might proceed without too much risk to predict that some persons now living will see the day when technology has reached such a state that particular relocation of old industry and location of new and additional industry will be determined largely by personal whim or, in some cases, by outright accident.

Material, physical, and mechanical factors, however, are not all that are involved. There is, in addition, all of what one might call the human elements--men and their institutions. Here again the advancement of technology is a significant feature. As technology advances, changes occur perhaps not in men, but certainly in the institutions and in the thinking of men. Following in the wake of increasing power production, there have occurred in the United States in this century various institutional devices and procedures such as big corporations, big labor unions, and big governments, as well as corresponding changes in the thinking on the affairs of men. Thus, operating both directly and indirectly, advancing technology has shifted the determination of the relocation of old industry and the

location of new and additional industry. The change has been from the material, physical, and mechanical factors to the institutional factors. A net result is that "the labor climate" and "the government climate" have become significant elements of the determinants of industrial location --perhaps the major elements.

Microfilm $4.80; Xerox $16.00. 375 pages.

ECONOMICS, FINANCE

AN INVESTIGATION OF THE ALLEGED DISCRIMINATORY IMPACT OF GENERAL CREDIT CONTROLS DURING PERIODS OF MONETARY STRINGENCY

(L. C. Card No. Mic 59-4227)

Harmon Hayden Haymes, Ph.D.
University of Virginia, 1959

Variations in the impact of general credit policy have led to widespread charges that the use of general credit controls to combat inflation discriminates against some borrowers and lenders and in favor of others.

This study points out that some of these variations are the result of differences in the reactions of individual participants in the credit markets to changes in the cost and availability of credit, and that they are characteristic of the free market mechanism. The more important variations in the impact of credit restriction are shown to be the result of imperfections in the markets for loanable funds.

In the market for state and local government securities, maximum legal interest rates for these issues together with the tax-exempt feature cause the impact of general credit restriction to be particularly severe. A state or local government cannot successfully market securities when general credit stringency forces rates on similar issues above the maximum permitted by law for such a government. In addition, restrictions on credit expansion may keep the market for tax-exempts from growing rapidly enough to absorb the increasing supply of such issues.

The major imperfection in the market for mortgage credit is the existence of maximum interest rates for FHA and VA insured and guaranteed loans. When rates for loans of the same general type rise above these maximum rates, the effective demand for funds in this market is sharply curtailed. Institutional arrangements such as the forward-commitment process and mortgage warehousing also play a part in altering the impact of credit restriction in this market.

Small businesses were found to be hit hardest by credit restriction in those areas where they are dependent for borrowed funds on large banks, the most important customers of which are large businesses. When credit expansion is limited and interest rates rise, the large customers of large banks tend to stay out of the long-term credit markets for a time and use their lines of credit with the banks to expand their short-term borrowing. The large banks find it necessary to refuse loans to smaller customers in order to meet their commitments under existing lines of credit. The statistics are consistent with a substantial substitution of trade credit for bank credit by small businesses when they are refused bank credit, but present institutional arrangements for the provision of small-business credit do not seem to be entirely adequate.

Maximum legal interest rates and finance charge constitute an imperfection in the market for consumer credit which could limit the supply of funds for consumption loans if other rates should rise high enough to make consumer loans unattractive investments at these maximum rates, but the possibility of such a development seems remote. General credit restriction in recent years has not deprived consumers of credit; but changes in the rate of increase of consumer borrowing seem to indicate that general credit controls exert an indirect influence on the demand for consumer credit by changing consumers' expectations.

The variations in the impact of monetary restriction which have led to charges of discrimination are not the result of the use of general credit controls as such, but of market imperfections which cause those controls to bear more heavily on some borrowers and lenders than on others. This suggests that the problems arising from variations in the impact of general credit stringency should be dealt with, not by an attempt to equalize the impact of credit restriction through the imposition of selective controls, but by an attempt to remove the market imperfections which cause these variations.

Microfilm $2.90; Xerox $10.00. 223 pages.

THE TAX ON VALUE ADDED

(L. C. Card No. Mic 59-4094)

Clara Katherine Sullivan, Ph.D.
Columbia University, 1959

The study undertakes an extensive inquiry into the problems encountered in constructing and applying a general tax on value added. This impersonal, indirect approach to general taxation has been the subject of considerable interest since its adoption by the French National Government in 1948, the Shoup Mission's recommendation of 1949 for its use by the Japanese prefectures, and its utilization by the State of Michigan from 1955.

The investigation is divided into two parts. Part I, comprising the first five chapters, is concerned with a history of the concept and its application and, in the course of the discussion, calls attention to a number of significant issues. Chapter I briefly surveys the development of the concept from its origin about four decades ago as an idea for correcting the subsidy to integration under the ordinary turnover tax caused by multiple taxation of items entering into "cost of sales." As the discussion points out, the early proponents of the tax and their followers apparently envisaged a type of levy which may be designated as a "gross-product-type tax" while most modern students have been interested in either an "income-type tax" or a "consumption-type tax." The essential difference among the various concepts lies in the treatment accorded investment goods. The gross-product-type tax, being imposed on the value of a concern's gross product, permits no deducation for depreciation of physical capital and thus contrasts sharply with the income-type tax which allows depreciation. The

most generous treatment of investment goods is provided by the consumption-type tax, especially in the form known as the "deduction variant" which, by excluding all capital outlays from the tax base, rests only on consumers' goods.

Chapters II and III discuss the development and application of the value-added concept in France where it was introduced in 1948 as a gross-product-type tax by merely modifying the technique of collecting the prevailing manufacturers' sales tax. It was later adapted to the Monnet Plan for increasing French national productivity through successive modifications which turned it into a consumption-type levy. Chapter IV discusses the Michigan Business Activities Tax which began as a gross-product-type tax but was later modified in the direction of the income-type concept by allowances for depreciation on real property. Chapter V reviews the Shoup Mission's proposal for a value-added tax in postwar Japan which would have allowed taxpayers a choice between the deduction variant of the consumption-type tax and an income-type tax.

Part II of the treatise endeavors to clarify the nature of the value-added tax in the light of current national-income and tax theory. Chapter VI examines the rationale behind the various types of concepts. It also takes account of the variation in the distribution of the tax burden by type of value-added concept. The gross-product-type tax probably exhibits a high degree of progression although the precise pattern of this progression is unknown. The income-type levy is proportional while the consumption-type tax is regressive. Chapter VII studies the relationship of the value-added concepts to those utilized in national-income accounting. Chapter VIII explores administrative problems and demonstrates that the value-added levy may be regarded as an alternative method for collecting single-stage sales taxes. Chapter IX briefly discusses a few of the most important questions which have arisen in analyses of the incidence and effects of value-added taxation. It is mainly devoted to an inquiry into the extent to which the tax may be regarded as a "neutral" levy in the sense of avoiding a modification in the allocation of the economy's resources. The study concludes with a short appendix which considers the potential yield of the tax.

Microfilm $6.55; Xerox $22.60. 513 pages.

ECONOMICS, THEORY

ECONOMIC THEORY AND FOREIGN SALES FORECASTING

(L. C. Card No. Mic 59-4050)

Harry Anderson, Ph.D.
Columbia University, 1959

The central objective of this paper is to explore how economic theory can be utilized in the estimation of an American company's export opportunities.

Although a relatively new activity, systematic sales forecasting is now widely practiced in the United States. However, the market area at interest seldom extends beyond national boundaries. There are good reasons for that. For one thing, the American domestic market is so vast that foreign sales opportunities are only of marginal importance to most United States producers. For another, international commerce links areas controlled by different governments and separated by barriers preventing the free flow of trade and productive resources. Export sales are thus subject to changes in regulatory and competitive circumstances quite unknown in domestic trade. Moreover, market data are less adequate in many foreign countries than they are in the United States. These facts militate against the successful use of most conventional forecasting techniques in the foreign field. The most promising approach to export sales estimation appears to be one combining two or more of the familiar basic methodologies.

What is the logical form of such a "mixed" technique in the domestic as well as the foreign field? What are its merits and its defects? And, finally, to what extent can it rely on guidance provided by general economic knowledge as embodied in conventional theory? These are the major questions with which the present paper is concerned. The theoretical discussion is supplemented by an appraisal of various export sales forecasts made in recent years and by an empirical illustration. The latter shows how the tools of economic and statistical analysis can be brought to bear on the problem of estimating future American refrigerator sales to Ecuador.

Microfilm $3.35; Xerox $11.40. 260 pages.

INSTITUTIONAL LENDERS IN A LOCAL RESIDENTIAL MORTGAGE MARKET, LOS ANGELES COUNTY 1946-1951

(L. C. Card No. Mic 59-3996)

Clayton Clyde Curtis, Ph.D.
Indiana University, 1959

The field of residential mortgage lending may be approached from several directions. One fruitful approach is to subject a particular market to careful study over a period of years. The purpose of this study is to describe and analyze the residential mortgage lending activities of a selected group of institutional lenders in Los Angeles County during the period 1946-1951. The three institutions selected for study are savings and loan associations, commercial banks, and life insurance companies.

The demand for mortgage credit is a derived demand having its roots in the demand for residential dwelling units. In order to understand the major demand forces in the Los Angeles County residential credit market during the six-year period it has been necessary to investigate briefly the County's housing market, including changes in population and families, income payments, and prices. The general direction of change of these variables supports the view that for the period as a whole demand pressures were high.

To place the method and scope of this study in perspective, a review of the literature on mortgage finance was made with special emphasis on works dealing with local markets or institutional lenders. Certain individual market studies discussed in this review are compared in the last section of this study with the Los Angeles County market. The body of the study shows clearly that generalizations about local markets made on the basis of aggregate

data are risky. The comparison of the Los Angeles market with other markets shows that it is equally dangerous to apply conclusions about lender behavior obtained from a study of one market to another local market.

Each of the three major institutional lenders operating in the County during the years 1946-1951 is subjected to separate and detailed investigation. The attempt is to uncover the important variables which influence decision making in the residential mortgage lending field. The nature and function of each group has a significant impact on the volume and kinds of lending which each group will undertake.

There are several other factors which affect in varying degrees the mortgage lending by these institutions. Some of the more important factors are the size of the firm and the size of the market in which it operates, money market changes, the volume of savings accumulated by the institution, the number of branch offices, the historical background of the institution, and the lending philosophies of individual firm managers.

From the comparison of other markets with the Los Angeles County market a hypothesis is constructed relating the structure of a local market to the volume of FHA-insured and VA-guaranteed loans made in that market. The hypothesis is subjected to a crude test and is tentatively substantiated. Several possible solutions to the problem of differential availability of FHA and VA funds among markets because of varying market strcutures are discussed. Two suggestions for further research are advanced. One suggestion looks hopefully to additional local market studies to verify and expand the conclusions of this study. The second recommendation suggests a series of studies of individual lending firms as one approach to the problem of understanding management attitudes toward mortgage lending and differences in those attitudes among similar firms. Microfilm $6.95; Xerox $24.00. 546 pages.

THE WORKABILITY OF THE INPUT-OUTPUT ANALYSIS

(L. C. Card No. Mic 59-4112)

Michio Hatanaka, Ph.D.
Vanderbilt University, 1959

Supervisor: Professor Nicholas Georgescu-Roegen

This dissertation presents statistical tests of an input-output model, making use of time series of outputs and final demands. Herein are shown for the first time the tests based on a 1947 United States input table, utilizing the data not classified for purposes of national security.

Input-output models based upon the 1939 United States tables were the objects of several statistical tests. In comparison, the 1947 tables were constructed under generally far better circumstances than the 1939 tables. According to Professor Leontief, 25 to 30 percent of total outputs is left unallocated in the 1939 tables, whereas there are practically no unallocated outputs in the 1947 tables. Furthermore, the input-output models obtained from the 1947 tables differ in their conceptual frameworks from the models based upon the 1939 tables.

The methodology of the tests in this dissertation can be summarized as follows. The hypothesis of the input-output model is that the input coefficients are constant. From this hypothesis three testable relationships can be derived. Actually only two of them can be tested by using the presently available statistical data. The first relationship which is tested in this dissertation involves the final demands as predictors and the outputs as predictands. The second relationship which is tested in this dissertation involves the outputs as predictors and the sums of indirect demands as the predictands. Different test criteria are given by different definitions of the admission subsets and the rejection subsets for each testable relationship. These definitions take account of different meanings in the context of which the hypothesis of constant input coefficients is presented.

Most of the empirical tests in economics have this disadvantage: the existence of very large observation errors is often indicated by large discrepancies between the data obtained from two independent sources for the same concept, and yet not much information is available on the patterns of the observation errors. The tests of the input-output model are no exception to it. However, the author analyzes the mechanisms through which the possible observation errors affect the results of the tests. This analysis enables us to distinguish the tests which appear to be fairly independent of observation errors from other tests.

The conclusions can be paraphrased as follows. Concerning the relationship between the final demands as predictors and the outputs as predictands, the 1947 input-output model is fairly adequate but not excellent, when it is applied to a short period around the base year 1947. However, the 1947 input-output model is not adequate in its application to a long period, although it is not as deficient as the 1939 input-output models.

The relationship between the outputs as predictors and the sums of indirect demands as predictands is tested only for long periods. The conclusion with regard to this relationship is that the input coefficients are not constant in any of the following three meanings: 1) leaving the residuals random, 2) having no trends, and 3) independent of the conditions peculiar to a war economy. Additional tests indicate that the changes in input coefficients cannot be explained solely by price substitution or by non-homogeneous linear input functions.

As a by-product these tests discern some of the directions toward which the modification of the input-output model should be oriented. Within the range of topics with which the author has dealt with, he finds the trends in input coefficients as the only positive suggestion to be taken into consideration. Microfilm $4.70; Xerox $15.80. 367 pages.

PRICE BEHAVIOR AND PRODUCT DIFFERENTIATION

(L. C. Card No. Mic 59-4231)

Harry L. Johnson, Ph.D.
University of Virginia, 1959

This study attempts to examine empirically the phenomenon of price within differentiated product groups. Specifically, an attempt has been made to determine whether observed price behavior within the household appliance industries following the excise tax reduction of

April 1, 1954 is consistent with the implications of monopolistic competition or the theory of price via the "plateau" demand curve. The theory of monopolistic competition attempts to invalidate the neo-classical equilibrium of the firm by classifying buyers as "scale-preference buyers." The implicit assumption is that buyers respond to price changes only through a scale of preferences, i.e., buyers order competing products "strongly." As a result the firm is faced with the ordinary negatively sloped monopoly demand curve which prevents the equality of price and marginal cost. In this logic there seems to be an implication that relative prices will vary with proportional shifts in costs, ceteris paribus. The "plateau" case allowing for the presence of "marginal buyers" within the markets of differentiated products, suggests that price will be set at the margin and that relative prices will remain constant after proportional shifts in costs, ceteris paribus.

This work has attempted to investigate the hypothesis that relative prices remained constant after the tax reduction. The study considered, first, the logic underlying both theories; and secondly, the consistency of actual price behavior with that predicted by the two theories. With the use of a hypothetical case it was demonstrated that only under the "plateau" case would individual prices tend to decrease by the full amount of the tax and relative prices remain constant after the tax reduction. The conformance of this conjecture to actual market phenomena was determined by observing actual price changes in manufacturers' and suggested retail prices before and after the tax reduction. The evidence derived from these observations being quite consistent with the "plateau" case appeared to contradict the case for monopolistic competition.

A synthesis of the empirical findings are: individual price changes in manufacturers' prices were concentrated between 3.9 and 4.9 per cent; changes in suggested retail prices ranged between zero and 8.0 per cent; the coefficients of correlation calculated for price before and after the tax reduction approximated one (.999); and regressions for the larger appliances (refrigerators, ranges, and freezers) suggested that the price after the tax was 95.45 per cent of the price before the tax. The significance of these findings was derived by comparing them with the predictions of the "plateau" case. For example, the predicted change in individual prices was 4.55 per cent (the mean observed price change was 4.47 per cent); the price after the tax was predicted to be 95.45 per cent of the price before the tax; and the predicted coefficients of correlation were one. It is clear, from the examination made, that actual price behavior conformed with the implications of the "plateau" case and not the case for monopolistic competition. What this seems to indicate is that individual firms within the household appliance industries were not in a position to take advantage of consumer attachment as suggested by monopolistic competition, but were forced to compete for the general market as in the ordinary competitive case.

This study was not intended to provide final and definite answers to the problem of price of differentiated products, no one study could possibly do so. It is confidently hoped, however, that this study may serve as a guide for further study and explorations of the phenomenon of price in markets of differentiated products.

Microfilm $2.15; Xerox $7.60. 163 pages.

A THEORY OF THE BANK FIRM

(L. C. Card No. Mic 59-3964)

Thomas Edward Van Dahm, Ph.D.
University of Michigan, 1959

The problem with which this dissertation deals is to devise a theoretical framework in terms of which the bank can be analyzed and then to demonstrate the usefulness of this framework as a means of bringing together the abundant and varied literature on the subject of bank behavior.

Although probably no class of firm has been written about so extensively and from so many points of view as the bank, there is no generally-accepted analytical framework for the theoretical treatment of the bank. By way of providing a background for discussion, recent attempts to remedy this shortcoming are discussed in Part I, as are examples of the utilization of the apparatus of conventional micro-economic theory, and the uses and shortcomings of these approaches are pointed out.

The bulk of the dissertation, Parts II and III, concerns the determination of the equilibrium balance sheet - composition and size - of the bank firm. For expository convenience, separate treatment is given to three aspects of this problem - the asset-mix, the liability-mix, and size - with the first of these being stressed, since it is far more amenable to control by the bank than are the other two, under ordinary circumstances. Throughout the discussion the arguments are buttressed by citations from the literature on banking, both to give the weight of expert opinion to the arguments and, in many cases, to place the discussion on a less abstract level by introducing empirical evidence from various case studies and statistical investigations.

Part II comprises the development of a theory of bank asset-structure determination. To introduce this topic, a simple three-asset model of the bank is presented and discussed. The bank's preferences among various combinations of these assets is considered determined by relative gross yield, risk, and costs. The purpose of this model is not to simulate the bank, in the sense of explaining its complex operations by a system of equations, but rather to draw attention to what are generally agreed to be the crucial factors underlying bank asset-mix decisions and to provide a suitable framework in terms of which these factors can be systematically analyzed.

Following the discussion of the model, the rest of Part II is largely organized around these three basic asset-structure determinants - gross yield (with emphasis on interest rate level and structure), risk, and cost - in an attempt to spell out, for each of them in turn, the nature of the determinant itself, the factors which influence it, and the bank's reactions to changes in it, as these reactions are manifested in the bank's asset pattern. This Part closes with a Chapter on the nature and effects of government regulations designed to influence bank asset choices directly rather than via the three abovementioned determinants.

Equilibrium liability-mix and size are then described and analyzed, in Part III, in a manner similar to that used in the asset-mix discussion. That is, the influences which bear upon liability-structure preference and size-preference are identified and discussed, making use of references

from banking literature to verify and illuminate the discussion. An effort is made to point out the interrelationships among asset-mix, liability-mix, and size determination.

Following a summary of the dissertation, and consisting of its conclusion, are some suggestions for broadening, deepening, and applying the theory of the bank firm developed in this study.

Microfilm $4.35; Xerox $14.60. 338 pages.

EDUCATION

EDUCATION, GENERAL

THE RELATIONSHIP OF SELECTED FACTORS TO THE ABILITY TO SOLVE PROBLEMS IN ARITHMETIC

(L. C. Card No. Mic 59-3057)

Vincent Eugene Alexander, Ed.D.
University of Southern California, 1959

Chairman: Professor Naslund

The purposes of this study were (1) to ascertain the relationship of selected factors to ability in arithmetic reasoning, (2) to compare high and low achievers in arithmetic reasoning with respect to selected factors, and (3) to determine the significance of sex differences in ability to solve arithmetic problems and in the strength of the relationship between each factor and ability in arithmetic reasoning.

Correlation techniques, including partial and multiple correlations, and t ratios were used to analyze the obtained data for each sex as well as for the total sample of 623 pupils drawn from the seventh grades of a costal community in Southern California and a medium-sized city in the metropolitan area of Los Angeles. Intelligence was controlled by partial correlation and by matching pairs of subjects according to I.Q. and mental age. The significance of the difference between two correlations was determined by a chi-square test involving z coefficients.

Findings. Factors that appeared to be closely related to ability in arithmetic reasoning were (1) ability to understand verbal concepts, (2) mental age, (3) general intelligence, (4) reading comprehension, (5) reading vocabulary, (6) arithmetic concepts, (7) arithmetic computation, (8) ability to analyze verbal problems, (9) general ability to interpret data, (10) perception of relationships involving comparison of data, and (11) recognition of limitations of given data.

Going beyond the data and crude errors in the interpretation of data were factors that appeared to be significantly associated with low achievement in arithmetic reasoning.

Factors that did not appear to be closely related to ability in arithmetic reasoning were (1) chronological age, (2) socioeconomic status, (3) ability to visualize objects in two or three dimensions, (4) ability to write and talk easily, (5) ability to work simple quantitative problems accurately and rapidly, and (6) the error of overcaution or tendency of the pupil to require more information than necessary to make a decision in the interpretation of data.

Sex differences in the ability to solve arithmetic problems were not significant. In only two of forty-nine comparisons were there any significant sex differences in the relationship of selected factors to ability in arithmetic reasoning.

Conclusions. (1) Since general intelligence is closely related to achievement in arithmetic problem solving and since pupils differ greatly in general intelligence, great differences in the ability to solve problems are to be expected. To care for this wide range of differences, there should be a differentiated program of instruction in arithmetic problem solving. (2) The ability to understand verbal concepts, and not the ease with which words can be used, was significantly related to problem-solving ability. (3) General reasoning ability appeared to be a factor in the solution of arithmetic problems. (4) Ability to understand quantitative relationships and accuracy in computation are essential to the solution of arithmetic problems. (5) General reading skills and specific skills involved in reading and interpreting quantitative materials are significantly related to ability in arithmetic reasoning. (6) It does not seem to be essential that different instructional methods in arithmetic problem solving be provided for boys and girls at the seventh grade level. (7) Although limitations of the data necessitate withholding final judgment, the findings tend to indicate that accuracy in computation may be more important in arithmetic problem solving than speed in computation.

Educational Implications. (1) Written materials used in problem solving should be carefully selected with respect to vocabulary and language structure. (2) Industrial practices should promote systematic development of reading skills fundamental to reading and solving arithmetic problems, ability to interpret quantitative data, ability to understand mathematical relationships, and an understanding of the number system and accuracy in computation before speed in computation is emphasized. (3) Instruction in problem solving should be planned according to individual needs irrespective of sex.

Microfilm $4.70; Xerox $15.80. 367 pages.

AN EVALUATION OF THE CONTRIBUTION OF SELECTED FACTORS TO THE JOB SATISFACTION OF TRANSCRIBING TYPISTS WHO ARE BLIND

(L. C. Card No. Mic 59-2078)

Helen Bernadette Barshay, Ph.D.
New York University, 1959

The Problem

This study concerns itself with the evaluation of the contribution of self-concepts, vocational interests, attitudes

toward certain interpersonal relations, and attitudes toward blindness to the level of job satisfaction of sixty legally blind transcribing typists, between the ages of nineteen and fifty-six, currently employed in the New York area. Although about one hundred are so employed, only ten males and fifty females cooperated. However, this is a representative sample of the sexes.

Procedure

In the spring and summer of 1958, this investigator tested the research population individually, at a place convenient to them, using the following five devices:

1. Job Satisfaction Blank No. 5 -- to measure level of job satisfaction.
2. Index of Adjustment and Values -- to measure self-concepts. This yielded two scores: one on self-acceptance and another on discrepancy between the realized self and the ideal self.
3. Kuder Preference Record - Vocational - Form CH -- to measure vocational interests.
4. F Scale -- to measure attitudes toward certain interpersonal relations.
5. Attitudes re Blindness, a category from the Emotional Factors Inventory -- to measure attitudes toward blindness.

The multiple regression technique was employed to evaluate the relative strengths of the selected factors (the independent variables) on the level of job satisfaction (the dependent variable).

Results

None of the selected factors correlated highly with job satisfaction. Clerical interest was highest, and that was only .28. The multiple r was .32 -- not significant. Since the contribution of the selected factors was so slight and might as well be attributable to chance, no predictive index could be suggested.

The data were further analyzed; high and low scorers on job satisfaction were compared for frequency above and below the medians on the independent variables and for other factors which might affect level of job satisfaction. Males and guide-dog owners were also considered separately.

Conclusions

Eighty-five per cent of the subjects experienced varying degrees of job satisfaction, from mild to very high. Fourteen expressed extreme satisfaction (love or enthusiasm for the job), while only two admitted extreme dissatisfaction (hate or dislike for the job). The median age for the group was 35.5. Age, place of employment (public or private), length of time on the present job, number and kinds of previous jobs and the subject's degree of satisfaction in each case, were not significant in differentiating the high from the low scorers on the satisfaction index.

There is a slight tendency for those who are happier on the job to be higher in clerical interests and more ethnocentric. More of these are also totally blind, while a higher proportion of the dissatisfied have the greatest amount of residual vision.

There were two significant items (not included in the satisfaction index):

1. Which gives you greater satisfaction?
   Your job
   The things you do in your spare time
2. If you could have your choice of all the jobs in the world, which would you choose?
   Your present job
   Another job in the same occupation
   A job in another occupation

In their responses to these items, the high and low scorers on job satisfaction were significantly different beyond the one per cent level of confidence. Most of the high scorers found greater satisfaction on their jobs and would also choose their present job, while on both items only one of the low scorers gave similar responses. The ten males showed no definite patterns. Of the fourteen guide-dog owners, eleven had a high degree of job satisfaction. The significant factor in this instance may be total blindness. Microfilm $2.00; Xerox $6.60. 140 pages.

RELATION OF EMPATHY, SELF IMAGE, AND SOCIAL ACCEPTANCE AMONG GIFTED AND AVERAGE CHILDREN OF THE SIXTH GRADE

(L. C. Card No. Mic 59-3833)

Lois White Billinger, Ph.D.
The University of Connecticut, 1959

Statement of Problem. The major problem was to measure empathy in relation to self image and social acceptance among gifted and average children in the sixth grade in order to determine whether these concepts are affected by intelligence.

Procedure and Sources of Data. All sixth grades of a Fairfield County, Connecticut public school system were tested, totalling 283 subjects, of whom 100 were statistically analyzed. Fifty subjects ranged from 130-150 Intelligence Quotients, and were specified as gifted. Fifty were from 90-110 Intelligence Quotients, and were specified as average. Instruments included the Dymond Empathy Rating Scale (a predictive measure), the Science Research Associates Junior Inventory (used for both self image and human relations adjustment items), and the Cunningham Classroom Social Distance Scale (used for both group and self social distance). With Dymond's written permission, the wording of her scale was modified slightly for sixth grade use.

Questions and Techniques. Chi Square was employed to determine whether gifted and average children differ on empathy and on selected human relations adjustments items, on selected items describing self image, or on social acceptance.

The Pearson Product-Moment Coefficient of Correlation was calculated to determine relationships between intelligence and empathy and between intelligence and selected human relations adjustment items, between intelligence and self image, and between intelligence and social acceptance. The second technique was further calculated to determine relationships between empathy and selected human relations adjustment items, between human relations items and self image, between human relations items and classroom social distance, and between group and self classroom social distance.

Empathy was analyzed for projection and similarity. Chi Square was employed for projection and similarity differences between gifted and average children.

Major Findings:

1. Gifted children were significantly higher on empathic ability than average children.
2. Gifted with gifted showed significantly less similarity in self descriptions than gifted with average; average with gifted self descriptions approximated average with average.
3. Gifted children projected less than average, to near significance.
4. Gifted and average children did not differ significantly on human relations items; neither did they differ significantly on self image.
5. Gifted and average did not differ significantly on either group or self classroom social distance.
6. Small correlations were found between empathy and human relations items, between empathy and group social distance, between human relations items and group social distance, and between group and self social distance. None was statistically significant.
7. No relation was found between intelligence and social acceptance.
8. A significant relationship was found between human relations items and self image items, tested on the same instrument (SRA Junior Inventory).

Conclusions and Recommendations:

Gifted sixth graders excel in predictive ability. They project less and have less similarity of response. They have a slightly higher self image, but no higher social acceptance.

Since a significant relationship (.85) was found between self image and human relations adjustment when tested by the SRA Junior Inventory, it is recommended that further research be conducted where variables may be tested by positively correlated instruments or by an instrument where the intercorrelation of areas has been established. It is further recommended that research be conducted to differentiate between empathy as objective social insight and empathy as the ability to identify with and interact supportively with other people.

Since Dymond empathy scores and SRA Junior Inventory human relations item scores had little correlation, it is recommended that other empathy measures besides predictive ability be sought.

Since it is likely that factors may have operated at the sixth grade level that might not exist at other age levels, it is recommended that more research be conducted in relation to age grouping and the developmental approach to empathy. Microfilm $2.00; Xerox $5.60. 113 pages.

THE APPLICATION OF ELEMENTARY STATISTICS IN ANALYSIS OF DATA BY SELECTED SECONDARY SCHOOL STUDENTS

(L. C. Card No. Mic 59-4254)

Charles Martin Bridges, Jr., Ed.D.
The University of Tennessee, 1959

Major Professor: Woodrow W. Wyatt

Purpose:

The purpose of this study was to determine the ability to apt secondary school students to apply principles of elementary probability and statistical inference in the analysis of data following a semester of instruction in statistics and elementary probability.

Methods of Research:

1. A one semester course-of-study in elementary probability and statistical inference was developed which included discussion of the following sections:
   a. The components of a statistical investigation.
   b. Measures of central tendency and variability.
   c. Elementary probability.
   d. Discrete distribution functions.
   e. The normal distribution.
   f. Tests of hypotheses.
   g. Developing the statistical report.
2. A testing instrument, A Test of General Proficiency in Elementary Statistical Inference, was developed. This test was subdivided into three parts:
   a. Selection of the appropriate method for testing stated hypotheses or stated problems.
   b. General questions concerning the principles of probability and statistical inference.
   c. Mathematical solution of statistical problems.
3. A group of nineteen secondary school students in an experimental mathematics class was used as the experimental group and a group of thirty-one students in a Plane Geometry class was used as the control group. The experimental class was composed of four juniors and fifteen seniors.
4. Form A of the testing instrument was administered as a pre-test at the beginning of the period of instruction and Form B of the testing instrument was administered as a post-test at the end of the period of instruction.

Summary of Findings:

1. Analysis of the post-test scores for validity and reliability of the testing instrument gave significant coefficients of correlation in both instances.
2. Analysis of the data for differences between pre-test and post-test scores after correction for guessing resulted in a significant t-score for the experimental group.
3. Analysis of the data for differences between pre-test and post-test scores after correction for guessing resulted in a non-significant t-score for the control group.
4. Comparison of the sample mean difference scores for the control and experimental groups indicated a significant difference between the mean score for the control group and for the experimental group.

Conclusion:

The results of this investigation support the belief that apt secondary school students are able to apply the principles of elementary probability and statistical inference following a semester of instruction in elementary probability and statistical inference.

Microfilm $2.00; Xerox $5.00. 98 pages.

A DESCRIPTION AND ANALYSIS OF THE SCHOOL POPULATION IN GRADES ONE, SIX, AND EIGHT WITHIN THE NORFOLK, VIRGINIA, SCHOOL SYSTEM

(L. C. Card No. Mic 59-4250)

Richard Boynton Brooks, Ed.D.
University of Virginia, 1959

Purpose

It was the purpose of this study (1) to obtain a description of the pupils and classes in the Norfolk City Schools, grades one, six, and eight in terms of chronological age, mental age, intelligence, and achievement in the basic skills; (2) to compare resident and transient pupils in terms of mental ability and school achievement; (3) to compare pupils who attended school on a double-session basis with those who attended school on a single-session basis in terms of mental ability and school achievement; and (4) to establish norms for mental ability and school achievement based upon data obtained from the pupils of grades one, six, and eight of the Norfolk City Schools when they were tested for mental ability and school achievement.

Procedure

Pupils were tested with the California Short-Form Test of Mental Maturity and the California Achievement Test in the fall of the school year 1954-1955. Additional data relevant to their status as double or single-session pupils and transient or resident pupils was collected. Descriptions of these pupil populations in terms of mental ability and achievement were presented. Analyses, using the chi square technique, were made between double and single-session pupils and between transient and resident pupils. Percentile norms for total population, white population and Negro population were established.

Conclusions

1. First grade pupils exceeded their expected achievement in reading achievement, arithmetic achievement, language achievement, and total achievement.
2. Neither the sixth nor eighth grade pupils reached their expected achievement in reading achievement, arithmetic achievement, or total achievement.
3. Pupils in grades six and eight exceeded their expected achievement in language achievement.
4. There were no significant differences in terms of achievement between pupils who had attended school on a double-session basis and those who had attended school on a single-session basis.
5. There were no significant differences in terms of achievement between pupils classified as transient pupils and those classified as resident pupils.

Microfilm $2.95; Xerox $10.20. 226 pages.

AN ANALYSIS OF OPINIONS CONCERNING SELECTED CONCEPTS OF HOME ECONOMICS EDUCATION

(L. C. Card No. Mic 59-2964)

Bonnie Bell Buchanan, Ed.D.
The University of Oklahoma, 1959

Major Professor: Gail Shannon

This study was made in an attempt to find answers to the following questions relative to concepts valuable to home economics education:

1. What are the basic concepts in home economics education?
2. To what extent do educators concur upon these stated concepts?
3. Do home economists have the same concept of homemaking education as do school administrators?
4. Do educators tend to agree upon stated concepts concerning the relationship of the homemaking course to the total school program, the democratic process, education for home and family living, and the personal adjustment of the homemaking teacher?

Primary data were obtained by the use of an opinionnaire composed of ninety-three concepts pertinent to home economics education. Personnel participating in the study included first-year homemaking teachers, state supervisors, college professors of home economics education, school administrators, and a jury. There were one hundred ninety-seven participants, all from the same geographical area, except for the jury which was composed of outstanding home economics educators from throughout the United States.

Findings were presented by the use of tables showing responses for each of the concepts grouped according to professional class, five population groups, and three educational levels. For discussion purposes the items were divided into the following areas of major concern for home economics education:

1. Understandings concerning the relationship of homemaking to the total school program.
2. Understandings concerning the democratic process.
3. Understandings concerning education for home and family living.
4. Understandings concerning the personal adjustment of the homemaking teacher.

Forty-eight concepts received 75 per cent or more agreement by all participating groups and were accepted as basic for development in the home economics teacher training program.

Findings:

1. The teacher has a responsibility for integrating homemaking into the total school program.
2. An equitable plan for the homemaking teacher's responsibility for the total school program should be established.
3. Homemaking teachers feel inadequately prepared to sponsor co-curricular activities.
4. Teacher education should prepare teachers for coping with large classes, provide more experiences for developing proficiency in teaching boys and adult classes.
5. There is need for clarification of family-centered teaching for the homemaking teachers.
6. The responses of administrators and homemaking teachers indicate that democratic practice may not approach the democratic ideal.

7. Vocational home economics should emphasize other vocational aspects as well as homemaking.
8. Sponsorship of Future Homemakers chapters should be optional with the teacher and the administrator.
9. Homemaking courses may be trying to encompass too many areas of subject matter.
10. Size of community shows no significant influence upon opinions of concepts in home economics education.
11. In most instances the opinions of participants holding advanced degrees appeared to be more theoretical and less practical.

Microfilm $3.05; Xerox $10.40. 234 pages.

RANK BY SEX IN HIGH SCHOOL GRADUATING CLASS IN RELATION TO SCORES MADE ON SELECTED ENTRANCE TESTS AT INDIANA UNIVERSITY

(L. C. Card No. Mic 59-4270)

Raymond Stoner Butler, Ed.D.
Indiana University, 1959

Chairman: Philip Peak

Three questions were to be answered: (1) How did the final ranks of boys in a random sample of Indiana public high school graduating classes in June, 1958, compare with the final ranks of girls? (2) Did the relative ranks of boys and of girls in their graduating classes vary with size of school in the sample? (3) What was the relationship of high school ranks of boys and of girls to various test scores obtained by these individuals upon entrance at Indiana University in September, 1958?

A ten per cent random sample of the Indiana public high schools, stratifieid by school size-group, was selected, size being determined by number of sophomores, juniors, and seniors. The principals of high schools selected were asked to submit a list of their June, 1958, graduates by rank, name and sex. The ranks were analyzed by decile and by sex. In addition to analysis of simple rank, rank as correlated with Indiana University entrance test scores was studied. A total of 1,976 students from the Indiana public high schools who entered Indiana University in September, 1958, had records in the Junior Division sufficiently complete to permit comparison of high school rank with entrance test scores. These 1,976 students were selected for such a comparison and were classified by size of graduating high school. Correlation coefficients were tested for significance with the t test and differences between correlations by sex, with the z test.

The major findings may be summarized as follows: The median percentile rank of boys in the graduating classes in the 58 participating schools was 40.8 whereas the median rank of girls was 58.4. As size of school increased, boys' median rank increased and the median rank of girls decreased. Also, as size of school increased, the boys' rank increased except in high schools of over 500 students, in which boys ranked lower than in schools of 251-500. Girls, however, consistently outranked boys in all school size-groups. Of the total boys, 14.49 per cent were in the top fifth of the graduating classes whereas 25.51 per cent of the girls were in the top fifth; and 25.8 per cent of the boys were in the bottom fifth of the graduating classes compared to 14.27 per cent of the girls. When high school ranks of 1,023 boys and 953 girls were compared with scores on three entrance tests at Indiana University, all correlations were significant to the five per cent level and all but two were significant to the one per cent level. Higher percentile scores and higher correlations with rank were obtained for girls than for boys on the language arts tests, and boys' scores and correlations were higher than girls' on the quantitative test.

If rank continues to be the criterion for admission to college and if equality in numbers of boys and girls admitted is desired, separate entrance requirements should be established for boys and for girls. Size of high school should also be considered prior to admission based on rank. Girls are getting a better foundation in the language arts than are the boys. There was a close relationship between high school rank and test score.

Microfilm $2.00; Xerox $5.60. 115 pages.

GUIDANCE AND SELECTIVE RETENTION PRACTICES IN MUSIC TEACHER TRAINING

(L. C. Card No. Mic 59-2935)

Milton H. Genge, Ed.D.
University of Southern California, 1959

Chairman: Professor Rush

The purpose of this study was to establish criteria for guidance and selective retention practices in music teacher training. The investigation was made to determine (1) whether certain guidance practices were considered fundamental to the teacher training program, (2) to what extent these services were considered of value in the selective retention of students in the music education program, and (3) whether there was a difference in the recommended guidance practices as evaluated by leaders in music education and graduates of music education programs in Western colleges.

An evaluation schedule was constructed from (1) a study of the related literature, (2) a catalogue study of representative institutions, and (3) personal observation and interviews. The practices were organized into five general areas: admissions, orientation, testing, advising, and job placement and follow-up. After preliminary testing and refinment, the surveying instrument was sent to leaders in music education and to graduates of Western colleges recommended by a group of selected institutions. The respondent was asked to evaluate the various practices as essential, desirable, uncertain, or rejected.

Completed schedules were received from 122 leaders in music education representing forty-three of the forty-nine states and each of the six divisions of the Music Educators National Conference, and from 167 Western college graduates. This represented a return of 75.3 per cent of all evaluation schedules mailed. The completed schedules were arranged into six groups for purposes of analysis: supervisors, college personnel, vocal teachers, instrumental teachers, vocal-instrumental teachers, and teachers of music and other subjects. Two statistical methods for determining the significant difference between groups were employed: (1) the t-ratio for comparing uncorrelated means was computed from the difference between the mean

ratings of groups, and (2) the X^2 (chi-square) test of independence was computed from the observed data of the four groups of Western college graduates.

Findings. This investigation revealed that 92 of the 237 criteria contained in the evaluation schedule were considered essential or highly desirable guidance practices by leaders in music education and/or Western college graduates, and of this number 77, or 83.7 per cent, were deemed highly desirable and/or essential by both groups. Comparison of these ratings revealed significant differences for 32.6 per cent of the criteria.

Analysis of the ratings of the various subgroups revealed significant differences between vocal teachers and leaders in music education for approximately 12 per cent of the criteria, while differences were noted for approximately 24 per cent of the criteria when comparing the ratings of leaders in music education and teachers of music and other subjects. Also, there were fewer significant differences between the ratings of supervisors and graduates of Western colleges than between the ratings of college personnel and Western college graduates. Comparison of the observed data of the four groups of Western college graduates revealed only slight divergence of opinion between these groups for the various criteria.

Guidance and selective retention practices considered important by music education leaders and Western college graduates included preregistration orientation, preadmission testing, letters of recommendation, high school records, successful participation in music groups prior to college entrance, admissions interview, orientation week activities, music education orientation, leadership experiences, classroom musical competencies, solo and ensemble participation, a continuous program of advisement (academic, personal, and social), and placement and follow-up services.

Conclusions and Recommendations. This study indicated that guidance and selective retention should be a continuous program and suggested the need for an experienced music educator who would be responsible for the advising and guidance of all music education majors in the music education department. Further study should be undertaken in the areas of implementing the orientation program, the degree of functional performance competency necessary for effective classroom teaching, and reasons for music teachers leaving the profession.

Microfilm $5.45; Xerox $19.20. 426 pages.

SCHOOL MUSIC SERVICES IN STATE DEPARTMENTS OF EDUCATION WITH IMPLICATIONS FOR CALIFORNIA

(L. C. Card No. Mic 59-2937)

John Elwyn Green, Ed.D.
University of Southern California, 1959

Chairman: Professor Rush

The purpose of this study was to report the services offered by existing state music consultants and to investigate needs for a similar program in California. An effort was made to determine (1) the historical roots from which present state music consultant programs arose, (2) the qualifications and status of the current state music consultants, (3) the activities and scopes of current programs, (4) the state music education services being provided in California, and (5) the degree of importance which should be attached to such services in California.

The historical background of state music supervision, qualifications and status of present consultants, and activities and scopes of current programs were investigated. A questionnaire was developed that contained eighty music services frequently rendered by state departments of education. Sixty-six responses received from California college and university professors of music, city and county music supervisors, and state departments personnel represented a return of 76.74 per cent. There were two scales for responses to each of the eighty services, the extremes of which were used for comparative purposes. The Classical Pooled Formula was used to compute significant differences between the professor-supervisor and state department responses.

Findings. Current supervisory practices have evolved from teacher-training, administrative supervision, and special supervision. In 1915 Pennsylvania appointed the first state music supervisor, and by 1959 nineteen other states had similar appointments in effect. All state consultants held master's degrees and five had earned doctorates. Consultants averaged 16.5 years of professional experience prior to state appointment. The office was usually placed under Curriculum or Instruction in the state department structures, but no common title was found for the position. The mean of the means of the reported salary ranges was $7,512.30. Six consultants had at least one assistant, and all had some secretarial assistance. Many of the services offered by the states were similar.

Concerning the extent of state music activities in California, the state department and the professor-supervisor group were substantially in agreement in thirty cases. In fifty instances the state department expressed significantly more positive opinions than did the professors-supervisors, particularly in regard to advisory, promotional, and research services. In the degree of importance attached to the suggested services, the state department and professors-supervisors were in agreement for thirty-seven of the items. The professor-supervisor group attached greater importance to forty-three of the suggested services than did the state department, with the greatest number of differences appearing under in-service training, promotional, and research services.

Recommendations. The fact that (1) there is evidence of considerable disagreement between state department personnel and music professors-supervisors on the extent of state music services in California and (2) that the professors-supervisors attach a greater degree of importance to certain services indicates the need for a trained musician-educator in the California State Department of Education. It is therefore recommended that a State Consultant in Music Education be appointed. A careful selection would help to reduce existing differences of opinion and to meet the needs stressed in this study. Such a person would be in a position to coordinate all music activities of the State Department of Education and would also serve to grant music greater curricular stature in the eyes of administrators, teachers, and students.

The qualifications and status for the position, as found to be in effect in other states, would serve as a point of departure in the selection process. In addition to continuing

and improving the state music activities now generally agreed to be in effect in California, the music consultant should grant particular attention to the services suggested in this study where substantial differences were found between state department and professor-supervisor opinions.

Microfilm $3.95; Xerox $13.40. 306 pages.

PROBLEMS ENCOUNTERED BY THE FACULTY OF CENTRAL STATE COLLEGE, WILBERFORCE, OHIO

(L. C. Card No. Mic 59-4278)

Richard Demosthenes Kidd, Ed.D.
Indiana University, 1959

Chairman: Elvin S. Eyster

The Problem

The problem is a study of the difficulties encountered by the faculty of Central State College, Wilberforce, Ohio, that may result in hindrances to maximum effectiveness. Related to the problem is a study of the administrative and academic policies and practices of the College with a view to their improvement.

Procedure

Based upon a study of the literature and consultation with a number of Central State College faculty members, six potential problem areas were selected for study: physical working conditions; service loads; student personnel policies; instruction; academic climate; and remuneration, security, and welfare.

Sixth-one teachers at the College were interviewed, the difficulties of each teacher being recorded and analyzed. From the difficulties, specific problems were deduced. Assuming that teachers' problems, many times, result from practices of the institution, a study was made of the administrative and academic policies and practices of the College, the problems discovered serving as a basis. To determine whether the College administrative practices compared favorably with recommended practice, a comparison of practices of the College was made with those recommended in the literature.

Findings

The problems encountered pertained to factors related to policies and practices of the College as well as those resident in the individuals as teachers. The problems fell into five problem areas: physical working conditions, professional growth, faculty welfare, instruction and student relations, and participation in policy-making and faculty personnel administration.

Physical working conditions. The problems pertaining to physical working conditions were: (1) inadequate equipment and supplies; (2) insufficient office space and secretarial assistance; (3) inadequate classroom facilities such as storage, bulletin board and blackboard space; and (4) inefficient utilization of classroom space.

Professional growth. Two coordinate problems of professional growth were encountered: (1) a lack of professional knowledge, primarily that relating to the philosophy and objectives of college education in general, and of Central State College in particular; and (2) an attitude of inaction toward continual self-improvement and professional growth.

Faculty welfare. The problems of faculty welfare experience were: (1) lack of knowledge of the salary administration program at the College; (2) lack of understanding of the system of professional recognition; and (3) crowded conditions and maintenance of housing for faculty.

Instruction and student relations. The problems of instruction and student relations centered around: those created by the deficiencies of the teacher and those produced by the deficiencies of the students. These problems were: (1) inability to provide for individual differences of students because of insufficient student personnel information; and (2) lack of essential ability, preparation, and attitude of students necessary for college work.

Faculty participation in policy-making and administration of faculty personnel. Two problems of faculty participation were expressed: (1) insufficient participation by the faculty in formulating and revising policies and procedures pertaining to instruction and student relations, and (2) inadequate participation by departmental officers in the selection, promotion, and retention of faculty.

Conclusion

Notwithstanding the problems encountered, in the main, the faculty appeared free of many problems usually found in an institution of higher learning. Moreover, the majority of the policies and practices of the College in these problem areas had a high degree of adequacy and were adapted largely to the needs of the faculty. In general, the policies and practices of this College compared creditably with recommended college administrative policies and practices.

Microfilm $2.90; Xerox $6.00. 224 pages.

THE ROLE OF THE PUBLIC SCHOOL TEACHER IN LOCAL POLITICS

(L. C. Card No. Mic 59-3850)

Joseph Michael Manfreda, Ph.D.
The University of Connecticut, 1959

The problem of this study was to discover attitudes of status leaders in Connecticut, and more specifically in Meriden, Connecticut, on the question: Are public school teachers free to participate in local politics in the towns in which they live and teach? The major question was subdivided into subsidiary questions pertaining to teachers' rights to:

1. Join and hold office in all local organizations, including political clubs
2. Express their opinions on local problems by speaking at town meetings and public hearings; and by contributing articles and letters to the press
3. Register with a major political party, attend political party meetings, hold political-party office, and solicit votes in the interest of their parties.
4. Hold part-time public office, non-salaried and salaried.

Answers to these questions were secured from two groups of people called Universe A and Universe B. Universe A

was a state-wide universe, and the following response of 752 individuals (65.3 per cent) was received.

135 Chairmen, Boards of Education
123 Masters of Granges
177 Members, State House of Representatives
59 Judges, City, Town, and Borough Courts
105 Chairmen, Republican Town Committees
37 Presidents, Chambers of Commerce
21 Members, State Senate
95 Chairmen, Democratic Town Committees

Universe B was a town-wide universe. The town used was Meriden, Connecticut (53,000 population) because it was considered to be a typical Connecticut town. The following response of 116 persons (95.1 per cent) was secured:

19 Members, Board of Directors of the Chamber of Commerce
13 Members, Executive Board of the Leage of Women Voters
9 Members, Board of Directors of the Meriden Manufacturers Association
17 Members, Executive Board of the Parent-Teacher Association Council
18 Members, Executive Board of the Veterans' Council
20 Members, Republican Town Committee
20 Members, Democratic Town Committee.

Individuals in Universe A responded by questionnaire, while those in Universe B were personnaly interviewed by the investigator. In Universe A, one hundred respondents were women (13.3 per cent), and 652 were men (86.7 per cent). In Universe B, thirty-nine respondents were women (33.6 per cent) and seventy-seven were men (66.4 per cent). When both universes were combined, 139 respondents were women (16.0 per cent) and 729 were men (84.0 per cent).

The findings--The findings in this thesis supported the following role of the Connecticut teacher who lives and teaches in the same town:

First, the role of the public school teacher in non-political organizations is one of freedom of action. His participation in political organizations, although receiving majority support, is more limited.

Second, the teacher's expression of opinion on civic issues of importance is approved; however, it is strongly preferred that this opinion be expressed at public meetings rather than by letters and articles submitted to the local newspapers.

Third, the role of the teacher in local party politics is as follows:

1. He is not only free but is urged to register with a major political party.
2. He is free to attend meetings of his political party.
3. He should aspire to no political party office, with the possible exception of membership on his Town Committee.
4. He should hesitate to solicit votes in the interest of his party.
5. He should hold no public office, with the possible exception of a non-salaried appointive office.

Microfilm $2.85; Xerox $9.80. 218 pages.

IMPLICATIONS OF TECHNOLOGICAL DEVELOPMENTS IN INDUSTRY FOR TECHNICAL INSTITUTE PROGRAMS IN MECHANICAL TECHNOLOGY

(L. C. Card No. Mic 59-3851)

Fred Daniel Manganelli, Ph.D.
The University of Connecticut, 1959

Statement of the Problem. The purpose of this study was to determine the implications of technological developments in industrial practices for technical institute programs with special reference to the mechanical technology field.

Procedure. Information on specific technological developments was obtained from sources suggested by publishing firms and engineering societies.

Questionnaires, relative to significant technological developments and special technical information and special technical skills required of mechanical technicians were sent to fifty companies, engaged in metal products manufacturing in Connecticut, of which 70 per cent responded.

Questionnaires, relative to mechanical technology curriculum with reference to specific or related courses in areas of significant technological developments, were also sent to fifty technical institutes, of which 82 per cent responded.

Results. As a result of faster and better methods of production developed during World War II, together with increased demand for civilian goods following the war, many new technological developments produced new products, found new uses for materials and changed the design of others.

The new technological developments that were identified and came under such categories as: (1) Manufacturing Processes, (2) Developments in New Uses of Materials, and (3) Problems in Design; were not entirely new, but in many cases improvements over old methods. Of the eighteen developments that were identified, only five of them were reported as prevailing in more than 50 per cent of the plants that responded.

Industrial plants were vague and sketchy in response to what special technical information and special technical skills with respect to the technological developments are required of mechanical technicians. Additional information was obtained in personal interviews with chief engineers, tool engineers, development engineers and others. Many of the respondents suggested subjects similar to those generally found as basic courses in the mechanical technology curriculum of technical institutes.

Fifty-eight different subjects were reported as being necessary of which Hydraulics, Mechanics and Mechanisms, Chemistry, Machining Processes, Heat, Production Processes, Electronic Controls, Electronics, Electricity, Metallurgy, Heat Treatment, Materials, Tool Design and Instrument Reading, were mentioned with any noticeable degree of frequency.

Ninety per cent of the technical institute programs were organized on a two year basis, 100 per cent required high school graduation for admission and 83 per cent granted the associate degree.

Fifty-five per cent of the institutes determined changes in industrial practices by research, 71 per cent employed advisory groups to assist in the problem.

Ninety-seven per cent of the faculties kept up-to-date with industrial practices by reading technical journals and reports of technical societies, 58 per cent by taking technical courses, and 97 per cent by visiting industrial plants.

Ninety-seven per cent of the institutes made changes in the curriculum with respect to technological developments, however, not as specific courses, but as part of related or other courses in science, materials, processes, design and shop or laboratory.

Conclusions. There have been numerous technological industrial developments that have changed the manufacturing processes, materials used, and design of products. These developments occur as a series of steps or improvements to existing processes or methods.

The developments do not prevail in industry to the extent that is often indicated by reports and articles that appear in technical journals.

The analysis of the significant technological developments with respect to special technical information and special technical skills, produced very few items that could be considered new. In most cases the instruction is covered as part of courses that prevail in the curriculum; however, there were several areas which could be emphasized or expanded to include new information on prevailing processes.

Microfilm $4.00; Xerox $13.40. 310 pages.

A COMPARISON OF SELECTED FISCALLY DEPENDENT AND FISCALLY INDEPENDENT SCHOOL DISTRICTS

(L. C. Card No. Mic 59-3857)

James Joseph Naughton, Ph.D.
The University of Connecticut, 1959

Problem: The purpose of this study was to:

1. Determine whether or not dependent or independent school districts received a larger proportion of their revenue from local taxation.
2. Determine the effect of fiscal dependence and fiscal independence on the ratio that assessed valuation is of real valuation.
3. Determine the effect of fiscal dependence and fiscal independence on the ratio of tax rate for educational purposes and the tax rate for all other municipal functions.
4. Determine if fiscal dependence or fiscal independence had an effect on the ratio between bonded indebtedness for educational purposes and bonded indebtedness for all other municipal functions.
5. Determine whether or not there were any significant differences in per pupil costs in fiscally independent and fiscally dependent school districts.

Procedure: Research and literature pertaining to fiscally dependent and fiscally independent school districts were examined and the findings summarized. A questionnaire was sent to each superintendent of the 66 school districts in the United States which serve populations of between 40,000-50,000. Each superintendent indicated: the school district fiscal status, total average annual enrollment, the per cent of the local tax dollar spent for education, the sources and amounts of income for the last fiscal year, the amount of bonded indebtedness, the amount of money allotted by the school administration within its current budget for: (1) general control, (2) instruction, (3) operation of plant, (4) maintenance of plant, (5) fixed charges, (6) auxiliary services, (7) capital outlay, and (8) debt service. Also, of the amount listed for instruction, how much of this was for teachers' salaries. This information was tabulated by fiscal status--dependent or independent. Then the figures were converted to per cents. The arithmetic mean was determined by fiscal status for each item on the questionnaire. This was followed by the employment of the null hypothesis. Then, a test of the difference between the means for each of these items was given to determine if there were any significant differences. On the basis of the study, conclusions were drawn and recommendations made.

Results: The following are based upon the findings in light of the purposes of this study:

1. Fiscally independent school districts received proportionately less income from local taxation than did fiscally dependent districts.
2. There is no significant difference in the ratio that assessed valuation is of real valuation for fiscally independent school districts or for fiscally dependent school districts.
3. There is no significant difference in the ratio that tax rate for educational purposes is of the tax rate for all other municipal functions for fiscally independent or for fiscally dependent school districts.
4. There is no significant difference in the ratio that bonded indebtedness for educational purposes is of bonded indebtedness for all other municipal functions for fiscally independent school districts or for fiscally dependent school districts.
5. There is no significant difference in the per pupil costs in fiscally independent and fiscally dependent school districts except for fixed charges and debt service.

Conclusions: The following conclusions are made on the basis of this study:

1. Fiscally independent school districts cost no more to operate than fiscally dependent school districts.
2. Property taxes for school purposes are proportionately lower in fiscally independent school districts than in fiscally dependent school districts because fiscally independent school districts receive more state aid.
3. Fears, on the part of local tax payers in dependent school districts, that higher taxes would be the result if their school districts became fiscally independent, are unfounded.

Microfilm $2.00; Xerox $5.40. 109 pages.

A STUDY TO DETERMINE THE RELATIONSHIP BETWEEN THE POSITION OF TEACHERS ON THE CALIFORNIA F. SCALE AND THEIR DISPOSITION TOWARD TEAMWORK

(L. C. Card No. Mic 59-3860)

Joseph Francis Perez, Ph.D.
The University of Connecticut, 1959

The purpose of this study was to determine the relationship between the position of teachers on the California

F. Scale (a scale measuring authoritarianism) and their disposition toward teamwork. The author devised an instrument to measure teamwork disposition.

The author formulated the following hypotheses for testing:

1. There is a significant difference in the disposition toward authoritarianism between men and women teachers.
2. There is a significant difference in the disposition toward teamwork between men and women teachers.
3. Age is related significantly to teamwork disposition and to disposition toward authoritarianism.
4. There is a significant inverse relationship between disposition toward authoritarianism and disposition toward teamwork.
5. There is a significant relationship between experience and teamwork disposition and between experience and disposition toward authoritarianism.
6. There is no significant relationship between education and disposition toward teamwork and between education and disposition toward authoritarianism.

The results are as follows:

1. The mean score and standard deviation respectively for men, (3.576) (.6925), and the mean score and standard deviation respectively for women, (3.493) (.7098), together with the critical ratio value (.1155) indicates that there is little difference between male and female teachers as a group with respect to authoritarianism.
2. The mean score and standard deviation respectively for men, (30.619) (9.893), and the mean score and standard deviation respectively for women, (31.528) (8.444), together with the critical ratio value (.971) indicates that there is little difference between male and female teachers as a group with respect to teamwork.
3. There is a significant inverse relationship between disposition toward authoritarianism and disposition toward teamwork.
4. The age of a male or female teacher is related significantly to authoritarian score and to teamwork score. Critical ratios tests revealed that the following sex and age groups are positively related:
   (1) Young men and old women
   (2) Old men and young women
   (3) Middle men and middle women
5. These tests indicated that experience of a male or female teacher is related significantly to authoritarian score and to teamwork score. Critical ratios tests were calculated between male teachers with ten years or less experience and eleven years or more. Similar tests were calculated among female teachers.
6. These tests indicated that education of a male or female teacher is not related significantly to authoritarian score and to teamwork score. Critical ratios tests were calculated between men without Master's degrees and men with Master's degrees. Similar tests were calculated among female teachers.

The following conclusions are educed from the evidence presented in these findings:

1. Disposition toward authoritarianism and teamwork is a function of the age and sex of teachers. Men and women, except in the middle years, 3-140, tend to be at opposite poles with respect to both authoritarianism and teamwork.
2. Authoritarianism and teamwork are, except in the middle years, inversely related to a significant degree. Apparently, during these middle years, teachers' responses to educational stimuli are in a transition process. Responses which are found to be either inadequate or unnecessary are discarded until the response, believed to be the correct one, for the respective sex, is obtained.
3. The disposition toward authoritarianism and teamwork in a male and female teacher changes with the acquisition of experience. Apparently, forces are at work to alter type of reaction effected to educational stimuli as the individual matures with the teaching assignment. This works inversely with the two sexes. Thus, while a man's degree of authoritarianism will diminish with age and his disposition toward teamwork increase, a woman's degree of authoritarianism will increase and his disposition toward teamwork will decrease.
4. The Master's degree program does not appear to contain the quality or quantity of experience which will significantly mold or alter an individual in attitudes toward authoritarianism or teamwork.

Microfilm $2.00; Xerox $6.20. 126 pages.

A COMPARATIVE STUDY OF THE GUIDANCE PROGRAM IN THE PRIVATE AND PUBLIC JUNIOR COLLEGE

(L. C. Card No. Mic 59-3862)

Joseph Peter Rice, Jr., Ph.D.
The University of Connecticut, 1959

Purpose. The purpose for the study was to compare the guidance program of the private with that of the public junior college. Preliminary findings revealed that although descriptive studies about guidance programs in the junior colleges were sparce, certain suppositions were being entertained by people in the field concerning these programs. Based on the preliminary findings, it was assumed that the public junior colleges have adopted similar guidance aims and have developed uniform guidance programs and practices consistent with their aims and with authoritative guidance theory; also, it was assumed that the private junior colleges have adopted more unique and mutually dissimilar guidance aims resulting in guidance practices and programs which are heterogeneous and varying in quality. It was the purpose of the study to validate or reject these suppositions by gathering a body of data describing private and public junior college guidance practices, personnel, facilities, services, and related agencies.

Method. A sample of fifteen private New England and fifteen public California junior colleges were picked for study. They were chosen on the basis of: (1) geographical accessibility, (2) willingness to cooperate, and (3) representativeness. The entire guidance programs of these thirty junior colleges were systematically and intensively studied by means of: (1) a review and analysis of their publications, (2) personal interviews with their officials and guidance personnel, (3) questionnaires which were patterned after designs derived from the literature and sent to presidents, deans, guidance directors and teacher-counselors in these colleges, and (4) visits to their campuses for intensive investigations.

The data compiled by these methods were converted into tabular form, analyzed, and evaluated by comparison

with the composite description of sound guidance theory and practice derived from the literature.

Findings. Based on the specific findings of this study, general, but tentative, conclusions were drawn:

(1) The guidance aims of private and public junior colleges appear to differ qualitatively and in relative degree of acceptance, specifically:

(a) Private junior colleges emphasize the aims of mental health and personal guidance. They consider these purposes relatively essential as compared with all other broad purposes.

(b) Public junior colleges emphasize the aims of vocational and general guidance. They consider these relatively important.

(c) Both private and public junior colleges emphasize academic guidance and consider it to be of average importance as an overall philosophical aim.

(2) The guidance personnel in private and public junior colleges differ in many professional respects:

(a) Public junior college guidance personnel are chosen on the basis of standardized and professionally valid criteria. They have greater experience and training.

(b) Public junior college guidance personnel enjoy higher professional status and compensatory benefits.

(c) Guidance programs are usually administered by professionally competent guidance directors in public junior colleges.

(d) Public junior colleges use standardized and objective techniques to evaluate their guidance personnel.

(e) Public junior colleges have inservice training programs and standard educational growth requirements.

(3) Public junior colleges have more diversified guidance plant space, office help and facilities, although both private and public junior colleges have minimal facilities:

(a) Private junior colleges keep more extensive student files of superior overall quality.

(4) Both private and public junior colleges offer the standard guidance services listed in the literature including testing, orientation programs, academic counseling, medical services, placement agencies and follow-up studies, but differ with respect to:

(a) Public junior colleges offer more vocational counseling and their services are of more standard overall quality.

(b) Private junior colleges emphasize unique program aspects, especially social and specialized counseling.

(c) None seem to have psychiatric help, however.

Therefore, the supposition of similar guidance aims and practices made concerning public junior college programs could have been assumed for both groups. However, the guidance aims of private junior colleges as a group are qualitatively different from the aims of public junior colleges as a group.

Microfilm $2.35; Xerox $8.20. 180 pages.

SITUATIONAL FACTORS AFFECTING LEADERSHIP AT THE UNITED STATES COAST GUARD ACADEMY

(L. C. Card No. Mic 59-3863)

Ephraim Pandt Rivard, Ph.D.
The University of Connecticut, 1959

Statement of Problem. The major objective was to identify those actual behaviors characteristic of effective and ineffective cadet leadership at the United States Coast Guard Academy.

Method. The Critical Incident Technique was basic to this study. Cadets in the graduating classes of 1955 through 1958 at the United States Coast Guard Academy were asked to describe actual performances which demonstrated effective or ineffective leadership behavior - both at the Academy and on the Cadet Cruise. These behaviors were critical in the sense that they were judged to have been the determining factors in the successful or unsuccessful performance of duty. After preliminary individual and group interviews, a questionnaire was formulated to give structure to later interviews as data were collected during four years.

These critical incidents were then read over carefully to determine the main behavior theme of each incident. These main themes were expressed as short sentences describing that way of acting which contributed most to the effective or ineffective performance of the cadet in the incident. These main behavior themes were first grouped into major areas of behavior and then combined into subareas, or categories, under these major areas.

Findings:

1. The content analysis of the 1680 incidents resulted in thirty-four categories or critical behaviors grouped into the following five major areas of behavior: (a) Proficiency in Supervising Personnel, (b) Work Habits, (c) Proficiency in Professional or Technical Skill, (d) Acceptance of Personal Responsibility, and (e) Acceptance of Organizational Procedures and Discipline.

2. For evaluation of leadership behavior of cadets at the United States Coast Guard Academy the following ten behaviors were found to be the most critical:

a. The cadet developed teamwork and increased group effectiveness.
b. The cadet obtained cooperation by use of tact in giving an order or correcting a mistake.
c. The cadet made special efforts to help subordinates and to promote their welfare.
d. The cadet set a good example; he obeyed his own rules.
e. The cadet kept himself informed with respect to progress of individual cadets and individual needs of cadets.
f. The cadet demonstrated technical mastery at the job assigned.
g. The cadet was scrupulously honest and fair in dealing with others.

h. The cadet voluntarily assisted in work in order to achieve objectives.
i. The cadet planned his work and scheduled assignments so that job was completed on time.
j. The cadet gave co-workers reasons for assignments, rules, and decisions.

Conclusions:

1. Data of this study agree with the hypotheses that effective leadership is a function of at least three variables, namely: (a) the behavioral pattern of the individual, (b) the nature of the situation, and (c) the degree to which the behavior patterns employed by the individual are appropriate to the demands of the situation.

2. The data reveal that, although the ineffective behaviors reported for Academy and Cruise situations followed the same pattern, variability characterized the reporting of effective leadership.

3. The Cruise is the sort of activity which has tremendous potential for training leaders. Here the cadets face with real, live situations comparable to those they will have to face later as officers.

4. Serious consideration might be given to the contriving of situations at the Academy and on the Cruise demanding of leadership performances closely parallel to those required in the service, to aid in the translation of leadership principles into specific leadership action.

Microfilm $2.25; Xerox $8.00. 172 pages.

AN ANALYSIS OF THE EFFECT OF PARENT-TEACHER AND PARENT-TEACHER-PUPIL CONFERENCES ON THE PROBLEMS OF INTERMEDIATE GRADE PUPILS

(L. C. Card No. Mic 59-3864)

Joseph Philip Robitaille, Ph.D.
The University of Connecticut, 1959

The purpose of the study was to determine if the claimed superiority of the conference method of reporting pupil progress in the elementary school could be justified by objective data. To accomplish this, answers to the following questions were needed:

1. Does the conference improve a child's mental health by causing a reduction in the number of problems the child has?

2. Does the conference aid the child in his acceptance of himself, the school, and other individuals?

3. Do conferences which include the child as a participant as well as the teacher and parent result in a significant reduction in the number of problems?

4. Do the opinions of all the individuals participating in the conference, parent, teacher and child, corroborate the objective data that was obtained?

The experimental-control group method, along with an evaluative questionnaire, was used in the treatment of the problem.

Three classes each of fourth, fifth and sixth grade pupils were divided into three groups using different methods of reporting pupil progress. One group, the control group, continued receiving only the regularly scheduled report card. The second group had two parent-teacher conferences and the third group had two parent-teacher-pupil conferences added to the reporting procedure.

The instrument used to measure the effect that conferences had on the children was the Science Research Associates' Junior Inventory, Form A. This instrument was administered to all nine classes before conferences were scheduled and after the two conferences had been completed.

The means for all groups on both tests were calculated. The differences between the means were computed and then submitted to statistical tests.

An item analysis was made on thirty problem statements taken from the Science Research Associates' Junior Inventory. The thirty problems indicated feelings of anxiety, hostility, or rejection.

Following the completion of the second conference, an evaluative questionnaire was sent to each parent, child, and teacher who participated in the study.

Results from the statistical analysis indicated there was a significant reduction in the means of all experimental groups. The difference was significant well beyond the one per cent level of confidence. No such reduction was obtained for the control group.

The responses from the questionnaire indicated overwhelming acceptance of the conferences by parents, teachers and students.

From the data obtained through the study, the following conclusions were drawn:

1. It is possible to submit a reporting procedure to experimentation and to obtain objective evidence to justify the acceptance of that reporting procedure.

2. The claimed superiority for the conference method of reporting pupil progress appears justified when it is combined with a written report.

3. Conferences have an equally positive effect on all children in the experimental groups in the intermediate grades.

4. There was no significant difference in the reduction of problems of pupils who participated in the conference from those who did not.

5. Pupils who have problems indicative of poor mental health retain those problems unless means are undertaken to solve them.

6. Conferences have a definite, positive effect in reducing the number of problems which display evidence of poor mental health.

7. Conferences help a child free himself of negative attitudes toward school.

8. Parents are aware of the advantages of conferences and do believe they provide for better relations between home and school.

9. Intermediate grade pupils are capable of participating in the evaluative process.

10. Conferences are no panacea; some problems still remain even though the number was greatly reduced.

Microfilm $2.05; Xerox $7.20. 154 pages.

CHARACTERISTICS OF BEST LIKED TEACHER, LEAST LIKED TEACHER AND MOST EFFECTIVE TEACHER IN TEACHER TRAINING INSTITUTIONS

(L. C. Card No. Mic 59-3871)

George Flint Taylor, Ph.D.
The University of Connecticut, 1959

Statement of Problem: The purpose of this study was to find the answers to the following six questions:

1. What do college students believe to be the characteristics of their best liked teachers?
2. What do college students believe to be the characteristics of their least liked teachers?
3. To what extent is the best liked teacher also considered to be the most effective teacher?
4. To what extent is the least liked teacher considered to be the most effective teacher?
5. How does the most effective teacher differ from the best liked teacher?
6. Do women react differently than men to college instruction and college instructors?

Procedure: The study was based on a questionnaire sampling of seven hundred and seventy-five college seniors and graduate students attending twenty-one teacher training institutions in twenty-one states throughout the nation. The individual states were chosen by random selection and the co-operating teacher training institutions were also randomly selected within these chosen states.

Respondents described their best liked teachers, their least liked teachers and their most effective teachers using unstructured statements. The respondents also described these teachers by means of a check list of sixty characteristics.

Findings: Seven hundred and seventy-five respondents reported the following:

1. Characteristics of best liked teacher: skillful in measuring learning of students; obviously enjoys working with students; gives personal help to students; seems proud of his class; classwork is well planned; skillful in leading discussion groups; patient, kind, considerate; uses examples to clarify theory; helps beginners who grope or fail; and skillful in using data to analyze situations.

2. Characteristics of least liked teacher: tests chiefly for memorization of facts; resents disagreement with his viewpoint; superior, aloof, high hat; boasts of his own accomplishments; frequently reverses decisions; breaks rules he will not let students break; makes students feel inferior; cross, crabby, sarcastic; requires all students learn same thing; straddles fence on controversial issues.

3. Eighty-eight per cent of the respondents reported that their best liked teachers were also their most effective teachers.

4. No respondent reported that his least liked teacher was also his most effective teacher.

5. The most effective teacher differed from the best liked teacher in that he was more likely to make positive efforts to discover students' goals; he also utilized student opinion in evaluating achievement to a greater extent; his teaching seemed to be more consistent with educational theory.

6. Men and women reacted similarly concerning college instruction. There was little variance in their responses. Correlations between the scores of the sexes were found to be significant at the .05 level.

Microfilm $2.00; Xerox $7.00. 146 pages.

MOTIVATIONAL FACTORS IN CHOICE OF PROFESSION BY AMERICAN SCIENTISTS

(L. C. Card No. Mic 59-3675)

Ellsworth William Welch, Ed.D.
Stanford University, 1959

The Problem: This study investigates factors in the lives of American scientists related to the development of interest in science and to the choice of scientific work as a career.

Procedure: Scientists were defined as those who were employed as chemists, biologists, earth scientists, physicists, and astronomers. A questionnaire was used to identify factors influencing the development of scientists' interest in science. A total of 512 scientists in the south San Francisco Bay area completed the questionnaire, a 79 per cent response. From this sample, 101 scientists were interviewed to amplify, clarify, and verify questionnaire data. The percentage of scientists in each of the above categories corresponded almost exactly with the national averages. The sample used approximated the national average with respect to employment status--private industry, government, or educational institutions.

Findings: Scientists' mean age of first interest in science was 12.4 years. Critical ratio analysis showed that physicists tended to become interested in science earlier and showed less variation around the mean than other scientists. The data showed younger scientists tended to become interested in science earlier than their older colleagues.

The mean age of decision to become a scientist was 16.7 years with younger scientists having made this decision at an earlier age than older scientists. There was no significant difference between male and female scientists in age of decision, however, female scientists showed less variation in this regard.

The order of importance of persons who first interested scientists in science was teacher, self-interest, father, relative, young friend, mother, and adult friend.

Chi square analysis showed no significant differences when categories of persons who first interested scientists in science were compared individually with the following groups: (1) male and female scientists, (2) types of scientists, (3) younger and older scientists.

Similar analysis showed no significant differences when the question of persons who most interested scientists in science was considered.

Persons who most interested scientists in science were, in order of importance: teacher, self-interest, father, adult friend, relative, young friend, and mother. Character traits of influential teachers were reported.

The extent of teacher influence on scientists' choice of career was about equally divided among "much,"

"moderately," and "little or none." The teaching level of influential teachers in order of importance was high school, college, post-graduate, junior high school, and elementary school. Half of the scientists reported that school activities had a significant effect in arousing or continuing their interest in science. These activities in order of occurance were general class work in science or a specific science course, laboratory work, clubs, independent work and research, and field trips.

Recommendations: The data permit the following recommendations: (1) that science programs in the fifth, sixth, and seventh grades give more attention to vocational orientation, (2) that high school science teachers consider specifically vocational guidance in science, (3) that each science course in high school should include a study of science careers as they relate to the content covered in the course, (4) that school counselors provide more information about careers in science, and at an earlier age, (5) that class activities found to have been influential in encouraging interest in science -- laboratory work, clubs, independent projects, and field trips be increased, (6) that a wide range of science books and science magazines be available in class, and (7) that parent and adults concerned with encouraging scientific talent become aware of the importance of primary social groups in developing science interest.

Microfilm $2.00; Xerox $5.80. 116 pages.

EDUCATION, ADMINISTRATION

THE LEGAL STATUS OF THE CALIFORNIA PUBLIC SCHOOL PUPIL AND HIS PARENT WITH RESPECT TO ATTENDANCE

(L. C. Card No. Mic 59-3502)

Carl Roberts Ahee, Ed.D.
University of Southern California, 1959

Chairman: Professor Nelson

The purpose of this study was to analyze the organic laws, statutory provisions, appellate court decisions, attorney general opinions, rules and regulations of the state board of education, and selected county counsel opinions to determine the legal status of the California public school pupil and his parent.

Findings. Of approximately sixty findings presented in the study, the following were selected for presentation here: (1) The courts of California have tended to regard the opinions of the attorney general as of quasi-judicial authority. (2) The requirement for compulsory full-time attendance ceases the day before a minor's sixteenth birthday. (3) There has been no clear statutory or judicial definition of a private school. Very few legal restrictions are placed upon the standards and operation of private schools. (4) Governing boards of high school districts may be subject to court action for failure to provide part-time continuation classes as prescribed in the Education Code. (5) There has been disagreement among county juvenile and probation authorities in California with respect to the filing of petitions in juvenile court on behalf of incorrigible minors. (6) Varying opinions have been rendered with respect to the power of school personnel to control the police contact of pupils on school premises during school hours. (7) Conflicting legal opinions have been rendered with respect to the statutory provisions authorizing school districts to expend funds to provide medical and hospital insurance to pupils. (8) Weaknesses of the Continuation Education Law have resulted in difficulties in the enforcement of these statutes against sixteen- and seventeen-year-olds. (9) Limitation of statutory provisions pertaining to the issuance and cancellation of work permits for sixteen- and seventeen-year-olds has led to varying interpretations of the law by child welfare and attendance personnel.

Conclusions. Among conclusions drawn were the following: (1) In general the judiciary, when called upon to make decisions concerning the rights and obligations of public school pupils, have rendered decisions which have upheld as a state obligation the provision of education to all on equal terms. (2) Conflicting and uncorrelated legal opinions rendered by the attorney general and county counsels have resulted in discrepancies of action among school personnel at state and county levels with respect to the legal status of public school pupils. (3) This investigation revealed an urgent need for a number of amendments, deletions, and/or additions to legislative enactments pertaining to the attendance of public school pupils. Such changes would require as a preliminary step a thorough restudy of the Education Code.

Recommendations. Major recommendations included: (1) A central state agency is needed to render legal advice which would be binding upon all officials of the state public school system. The legal opinions of this agency would have the effect of law, until modified by a court of competent jurisdiction or superseded by subsequent enactments of the legislature. (2) Legislation should be enacted to provide minimal attendance standards for private schools reasonably equivalent to those prescribed for tutors and public schools. (3) The Education Code should be revised (a) to repeal or amend inoperative and redundant sections, (b) to add needed sections, and (c) to provide, with more systematic organization and simplified index, a ready source of information to persons interested in school law. (4) Governing boards should adopt written policies pertaining to the corporal punishment, exclusion, exemption, expulsion, police contact, and suspension of pupils. Policies should delineate the broad philosophy of the district concerning pupil control, should be flexible enough to meet all exigencies. Microfilm $5.95; Xerox $20.80. 466 pages.

SELECTED CHARACTERISTICS OF SCHOOL BOARD MEMBERS AND THEIR ATTITUDES TOWARD CERTAIN CRITICISMS OF PUBLIC SCHOOL EDUCATION

(L. C. Card No. Mic 59-3033)

Frank Robert Albert, Jr., Ph.D.
The University of Mississippi, 1959

Chairman: Professor S. A. Moorhead

The problem was to determine the relationship between selected characteristics of public school board members

in United States cities of 30,000 or more and their attitudes toward a group of selected criticisms of public school education. A secondary purpose was to determine to what extent changes occurred in the composition of public school boards serving in cities of 30,000 or more in 1958 as compared with the composition of these school boards in 1945.

A two-part questionnaire was used. Part I concerned age, sex, education, occupation, children, wards, or grandchildren attending public schools, tenure, and income of the board members. The replies were identified by geographic region and city size. Part II consisted of thirty statements of criticisms of public school education in the United States selected from current periodical literature, books, pamphlets, and newspaper articles. Response categories of "Strongly Agree," "Agree," "Undecided," "Disagree," and "Strongly Disagree" were assigned to each statement.

The questionnaires were mailed to all city school superintendents (396) in United States cities of 30,000 or more for distribution to board members. The 727 replies used in the study represented twenty-seven per cent of an estimated 2,688 board members in cities of 30,000 or more in population. All forty-eight states (1958) were represented.

The data obtained from Part I was compared with a related study conducted in 1945.[1] The analysis of variance technique and the t test were used in examining the relationships between the characteristics of board members and their attitudes toward the negative type criticisms contained in Part II. A significance level of one per cent was used. The study indicated that:

1. Board members differed significantly in their attitudes toward unfavorable criticisms of the public schools when the scores were classified by geographic region, age, and sex.
2. Board members in the Middle Atlantic states indicated more agreement with the negative criticisms of the public schools than did board members in the Middle States and Far West.
3. Board members in the Southeast region indicated more agreement with the negative criticisms of the public schools than did those in the Middle region.
4. Board members over sixty years of age showed significantly greater agreement with negative criticisms of the public schools than did board members from forty to fifty years of age.
5. Women serving on the school boards showed significantly less agreement with negative criticisms of the public schools than did the male board members.
6. The median age of school board members in cities of 30,000 or more was 48.6 years in 1958 and 50.8 years in 1945.
7. Women on the boards increased from fourteen per cent in 1945 to eighteen per cent in 1958. Women represented eighteen per cent of the membership of all boards in 1958.
8. Professionals, proprietors, and executives were the occupational groups most frequently represented in both 1945 and 1958.
9. Seventy-two per cent of the board members in 1958 were college graduates, twenty-four per cent were high school graduates, and the formal education of four per cent ended before high school graduation.
10. Seventy per cent of the board members in 1958 had one or more children, wards, or grandchildren attending the public schools; twenty-one per cent had children, wards, or grandchildren who had attended in the past; and nine per cent had had none attending the public schools at any time.
11. Fifty-seven per cent of the board members in 1958 had served from two to nine years. The median period of service was six years.
12. The median annual income of board members in 1958 was $11,968. The most marked increase in annual income level occurred in cities of 30,000 to 100,000.

Microfilm $2.00; Xerox $6.00. 124 pages.

1. National Education Association, Research Division of the National Education Association, "Status and Practices of Boards of Education," Research Bulletin, XXIV, no. 2 (Washington: National Education Association, 1946).

AN ANALYSIS OF THE POSITION OF FULL-TIME SUBSTITUTE TEACHER IN URBAN SCHOOL SYSTEMS OF THE UNITED STATES

(L. C. Card No. Mic 59-3503)

Kay Junior Anderson, Ed.D.
University of Southern California, 1959

Chairman: Professor Stoops

It was the purpose of this study to analyze the status, selection, and administration of the position of full-time substitute teacher in urban public school systems throughout the United States and to make recommendations based on the findings in an attempt to assist educators in providing for qualified uninterrupted instruction during regular teacher absence.

A preliminary survey with self-addressed postcard enclosed was sent to superintendents of 470 school systems located in cities of over 25,000 population throughout the United States. Thirty-five districts responded that they had a position of full-time substitute teacher as defined for this study. Administrators in twenty-six districts answered a questionnaire designed to ascertain existing and recommended practices in the utilization of this position.

Findings. (1) Eleven per cent of 323 respondent districts reported that they had a position of full-time substitute teacher. (2) Eighty-eight per cent of districts responding to the final questionnaire were located east of the Mississippi. (3) The majority of the districts reported that less than twenty-five per cent of substitute work was performed by full-time substitute teachers. (4) Seventy per cent of respondents reported major utilization of this position at the elementary level. (5) The primary reason given for establishing the position was to provide professional uninterrupted instruction during regular teacher absence. (6) Full-time substitutes were reported to receive full professional benefits and considerations in terms of salary, tenure, retirement, leaves, etc. Likewise, their professional and in-service requirements were the equivalent of those of the regular teacher.

Conclusions. (1) Although not experiencing rapid acceptance, a few additional districts utilize the position each year. (2) The necessity for professional substitute performance at least equal to that rendered by the regular teacher seems to be indicated by respondents as reflected in their selection policies and by their willingness to pay a professional price for professional service. (3) Wide variation exists in the assignment and total responsibilities of the full-time substitute teacher.

Recommendations. (1) With the principal pioneering going on in the East, it is recommended that other districts, regardless of size, experiment with the utilization of the position of full-time substitute teacher as one of the best answers to the difficult substitute teaching problem. (2) Districts investigating this plan should be guided by the ideal that boys and girls deserve the highest type of professional instruction even during regular teacher absence. (3) The title "permanent substitute teacher" is recommended. (4) These teachers should be selected, provided with full professional benefits, expected to meet equivalent professional requirements, and accepted on the same basis as their regular teacher peers. (5) The following policies should be considered in assigning teachers who constitute the permanent substitute corps: these teachers should be assigned to cover all types of substitute teaching assignments including day-to-day, long-term, etc.; they should be assigned to teach a specific subject or grade level in line with their qualifications; at the end of a certain period of permanent substituting some should probably be returned to a regular teaching position or possibly advanced to administrative or supervisory positions; if not utilized or needed each day in a substitute assignment the full-time substitute could be assigned to assist with the testing program, with the production and provision of instructional materials, or serve in a general way as a helping teacher; some should be assigned rather permanently to one school on the basis of previous substitute needs, enrollment, etc. (6) Districts should also consider the contracting of a few "permanent" substitutes on a part-time basis such as half-time or quarter-time substitute teacher who would work for a specified number of days and receive an equivalent portion of professional benefits.

Microfilm $5.15; Xerox $18.20. 403 pages.

A PROGRAM OF IN-SERVICE TRAINING FOR EDUCATION SERVICES PERSONNEL IN THE CONTINENTAL AIR COMMAND

(L. C. Card No. Mic 58-5724)

Theodore W. Balough, Ed.D.
Rutgers University, 1958

The problem. Three main areas were investigated. It was the purpose of this study (1) to examine critically the Education Services Program in the Continental Air Command to determine appropriate content for an in-service training program, (2) to examine the policies and investigate the practices of the seventeen major air commands in the United States Air Force concerning in-service training for personnel in the Education Services Program, and (3) to propose recommendations relative to an in-service training program.

Methods of investigation and sources of data. Types of the normative-survey method and sources used were: (1) critical review of official directives and informational material pertinent to the Education Services Program; (2) interviews with Air Force officials; (3) personal observation; (4) critical review of in-service training and related literature in education and guidance; (5) questionnaire-survey of practices and policies of seventeen major air commands; and (6) letters to school officials, agencies, and professional organizations. Data were assembled, interpreted, and selected with special reference to in-service training and the improvement of the Education Services Program.

Conclusions. With increasing emphasis on qualifications of school personnel, greater attention is being given to pre-service preparation and its importance.

The special role of in-service training is that it must compensate for the lack of any previous training, make adaptations to job situations, and provide for current knowledge and approved practices.

Two important developing fields of guidance and in-service training apply to education in general in the United States as well as to the Education Services Program. The major air commands affirmed the counseling function as most significant of the basic guidance services and the need for in-service training in the commands.

Two major problems in the Education Services Program pertain to command support and qualified personnel. The Continental Air Command, the Headquarters United States Air Force, and the major air commands can help meet the challenges these problems present by the utilization of the recommendations as set forth herein.

Recommendations. That the Continental Air Command consider the twenty-seven in-service activities and the seventy-nine subjects as developed in the study for the content of an in-service training program. Principles relative to the establishment of such a program, the publication of a directive, and a special training course for supervisors were also proposed. In addition consideration was given to the matter of evaluation.

That Headquarters United States Air Force and the major air commands accept the responsibility for in-service training; establish special courses for supervisors on in-service training responsibilities; appoint committees on in-service training and command support; and emphasize the role of guidance services.

Microfilm $4.80; Xerox $16.00. 375 pages.

FUNCTIONS AND RESPONSIBILITIES OF DEANS OF STUDENTS IN SELECTED NEGRO INSTITUTIONS OF HIGHER LEARNING

(L. C. Card No. Mic 59-4267)

James Dennis Beck, Ed.D.
Indiana University, 1959

Chairman: H. Robert Kinker

Problem: The purpose of this study was to analyze the office of the dean of students as chief personnel administrator in 16 Negro institutions of higher learning to determine to what extent a comprehensive set of functions and

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

duties were performed under the direction or coordination of that office. The investigation also examined selected characteristics of each institution as well as specific personal data concerning the chief personnel administrators.

Source of Data and Method of Procedure: Employing an interview guide which had been developed and refined prior to the investigation specifically for that purpose, the data for this study were secured from personal interviews with chief personnel officials in 16 Negro institutions of higher learning. These institutions represented an incidental sample of approximately 28 per cent of the total number of Negro colleges and universities located within the Southern Association of Colleges and Secondary Schools. Brief conferences with other officials in each institution and printed materials in the form of student handbooks and the like which were available at the time of the interviews provided supplementary information. The data thus secured were compiled and analyzed under the following headings: (a) Institutional characteristics and personal data concerning the chief personnel administrator, (b) Teaching duties of the chief personnel administrator, (c) Organization of the office of chief personnel administrator, and (d) The position of the dean of students as chief personnel administrator.

Major Findings and Conclusions: (1) Eighty per cent of the 16 chief personnel administrators, among whom the title "Dean of Students" was most common, reported organically centralized but functionally decentralized student personnel administrations; (2) part-time employment, providing chaperons, supervising extra-curricular activities, and corresponding with parents were functions predominantly performed entirely by the chief student personnel administrators; (3) the functions that were shared with other offices by a predominant number of personnel administrators involved operating the counseling program, handling discipline cases, administering scholarship funds, and curriculum development; (4) few of the duties and functions included in this study were coordinated by a majority of the chief personnel officials; (5) many student personnel duties were performed exclusively by other offices or departments without coordination by the chief personnel administrators; and (6) slightly over half of the administrators were members of the admissions, orientation, lecture, executive and testing committees, while only a few served as chairmen.

Although the majority of the student personnel administrators indicated organically centralized and functionally decentralized programs, it appeared from the findings that most of the programs were departmentally centralized apart from the over-all institutional functions and restricted in scope. The extent to which duties and functions relative to student welfare were directed and coordinated by the chief personnel administrators, as well as the number of functions performed in other offices with no coordination, indicated that most of the offices of these personnel administrators were considered as separately functioning departments. This suggested a general lack of coordination and integration.

The degree of participation of the chief personnel administrators on committees seemed to indicate that such groups were not utilized as a medium for the perpetuation of the personnel point of view. It further suggested that an awareness of the need for this point of view in these institutions may require strengthening. It was evident from the data in this study that a majority of the chief personnel officers spent most of their scheduled duty hours working with students, while comparatively little time was devoted to working with assistants and associates.

Microfilm $2.60; Xerox $9.00. 200 pages.

THE RELATIONSHIP OF BEHAVIORAL PATTERNS OF SELECTED SUPERINTENDENTS TO THE PROCESS OF PUBLIC SCHOOL DESEGREGATION

(L. C. Card No. Mic 59-4253)

Harry Smith Blanton, Ed.D.
The University of Tennessee, 1959

Major Professor: Galen N. Drewry

The problem of this study was to determine the results or effects on desegregation of behavioral patterns of school superintendents which developed when selected school systems became racially desegregated. The sub-problems were (1) to list and describe the forces that shaped the behavioral patterns of superintendents, (2) to relate the impact of forces to actions taken by the superintendents during desegregation, and (3) to determine the kinds of effects varying behavioral patterns had on the desegregation process.

The study was limited to ten public school superintendencies in Kentucky systems where some form of public school desegregation had been accomplished. The superintendents of the systems and the Kentucky State Department of Education cooperated in the study.

Data for the study were collected through personal interviews with the superintendents, other school personnel, and lay citizens in each of the ten systems. The official school board minutes pertaining to public school desegregation and other written material coming from the superintendent's office were examined in each school system. Newspapers were examined when these were believed to have taken an active part in desegregation.

An analysis of the data revealed that the influence behavioral patterns of superintendents had on desegregation was as varied as the behavioral patterns and that, in general, the behavioral pattern of the superintendent exerted less influence than other combined forces. Further, the behavioral pattern of the superintendent was itself affected by these forces.

The behavioral patterns of superintendents who took initial action and made careful preparations for desegregation were influential in establishing a calm, intelligent, and cooperative approach for desegregation in the public schools of Kentucky.

The behavioral patterns of superintendents who initiated action without careful planning for desegregation provided a disturbing air of confusion and passive opposition within the community. The failure to involve citizens in planning and to release formal plans from the superintendent's office gave incentives to doubt the sincerity of motives and direction of the program.

Superintendents who neither initiated action nor made formal preparation for desegregation were unable to

provide the leadership that was necessary for the assurance of an effective program of desegregation.

Microfilm $2.00; Xerox $6.60. 139 pages.

JOB ATTITUDES OF MIDDLE MANAGEMENT IN THREE COOPERATIVE EXTENSION SERVICES

(L. C. Card No. Mic 59-3171)

Margaret Carlson Browne, Ph.D.
University of Wisconsin, 1959

Supervisor: Professor Bryant E. Kearl

This exploratory study was designed to identify the factors that affect job attitudes of middle management personnel in the Cooperative Extension Services of three states, and to gain insight into the elements of the work situation which tend to produce satisfaction and dissatisfaction. The purpose of the study was to make such information available to Extension directors who might find it useful in making organizational and administrative changes. The broad areas explored in the study were: (1) purpose, prestige and administration of agency; (2) organization; (3) status; (4) communication; (5) supervisory role; (6) intrinsic job attributes; (7) technical competence of superiors; and (8) salary and fringe benefits.

All agricultural, home economics and 4-H state program leaders, district supervisors, and district administrators in the Extension Services of three states were interviewed, using non-directive interviewing.

Categorization and analysis of the data revealed that job satisfaction of middle management varied among states as well as among program groups. Factors relating to human needs and to the nature of the work appeared to be similar in the three states, and seemed to be producing about the same degree of satisfaction. Organization and administration differed in the three Extension Services, however, and these differences appeared to affect the attitudes of middle management personnel.

Job satisfaction appeared to be lowest where: (1) respondents felt least involved in decision making; (2) the biggest percentage of respondents indicated that their authority was not commensurate with their responsibility; (3) communication was judged to be inadequate; (4) there was the largest number of levels in the hierarchy; and (5) respondents perceived the agricultural group as having virtually all of the authority.

Job satisfaction appeared to be highest where: (1) the largest percentage of respondents felt involved in decision-making; (2) a high percentage believed that their authority was commensurate with their responsibility; (3) internal communication was judged to be adequate; (4) there were the fewest levels in the hierarchy and (5) authority was shared between agricultural and home economics people.

Job satisfaction seemed to be highest in the agricultural program group. This group: (1) held the most authority; (2) occupied the key points in the communication chain; (3) was regarded by the middle management group as having the highest status within the organization; (4) had the most tenure; and (5) received the highest salaries.

Job satisfaction appeared to be lowest in the 4-H group, despite the fact that their program was regarded as having the greatest public acceptance. It had: (1) the least authority; (2) was most often outside of the communication chain; (3) was perceived by the middle management group as having the lowest status of the three program groups; and (4) had the lowest average salaries.

The data indicated that: (1) the organizational structure with the fewest levels provided the greatest satisfaction and best communication; (2) delegating authority by function rather than by program group provided satisfaction for more people; and (3) "democratic administration" where decision-making was shared and where social distance was minimized produced good communication and a high degree of satisfaction within the middle management group.

Microfilm $2.95; Xerox $10.00. 225 pages.

RELATIONSHIP OF HIGH SCHOOL SIZE TO THE GUIDANCE PROGRAM

(L. C. Card No. Mic 59-3664)

Robert Curtis Bush, Ed.D.
Stanford University, 1959

Since World War II, an increasing number of communities which had only one high school needed room for additional high school pupils. Their concern has been with how large could the first high school become before starting a second school. In the planning for additional high schools, secondary educators have been asked to recommend what size high school is best to provide an educational program to meet the needs of today's youth.

There are many factors related to size of high school that could not be adequately examined in one study; therefore, four cooperative studies were undertaken to determine the relationship of high school size to curricular offering, guidance, staff relations, and school-community relations. The concern of this study was with the guidance program.

Procedures

Seventeen four-year high schools in the Bay Area of California, whose enrollments were greater than 800, participated in the study. Four questionnaires, each of which contained items pertinent to the area of guidance, were administered to samplings of different populations within these four-year high schools. The samplings included ten per cent of the parents of high school students, ten per cent of the students, fifty per cent of the teachers, and all administrative officers working within the school.

The seventeen schools were divided into four categories according to size: 800 to 1,199, 1,200 to 1,599, 1,600 to 1,999, and 2,000 and above. Two types of analysis were made: (1) a Chi-square test was used to determine if there were any significant differences in responses to each of the items in the questionnaires among the schools of a particular size category; and (2) the test for significance of difference of percentage was used to determine if there were significant differences in responses among the schools of different size categories.

The data were analyzed to determine if there were any relationships between size of high school and five specific services related to the guidance program:

1. Guidance Organization and Staff
2. Individual Inventory Services

3. Informational Services
4. Counseling Services
5. Placement and Follow-up Services

Results

1. Category II, 1,200 to 1,599, received the highest percentage of favorable responses for Individual Inventory Services, Informational Services, and Placement and Follow-up Services.
2. Category IV, 2,000 and above, received the highest percentage of favorable responses for Guidance Organization and Staff, and Counseling Services.
3. Category IV, 2,000 and above, received the highest percentage of positive responses for the total survey.
4. The parent and administrator questionnaires favored Category II, 1,200 to 1,599.
5. The student questionnaire favored Category IV, 2,000 and above.
6. Out of a possible sixteen items, which could be subjected to the Chi-square test, Categories II and III produced thirteen; Category IV, twelve; and Category I, eleven internally consistent responses.
7. When internal consistency is present in categories and the T-score can be used to determine if categories differ significantly, Category II, 1,200 to 1,599, is better than other categories eleven times as against five times for Categories III, 1,600 to 1,999, and IV, 2,000 and above.

Conclusions

The evidence of this sruvey indicates that there is no consistent pattern of significant differences that can be related to any one size category of schools for the total guidance program. Schools of 1,200 to 1,599 and those above 2,000 were favored for specific services by the respondents.

The lack of internal consistency for the category is a clue that factors other than size are important in determining the effectiveness of the school's guidance program.

Microfilm $2.00; Xerox $7.00. 147 pages.

A STUDY OF CHIEF SCHOOL ADMINISTRATOR OPINION REGARDING HUMAN RELATIONS BEHAVIORS OF PUBLIC SCHOOL ADMINISTRATORS

(L. C . Card No. Mic 59-3644)

Alfred Joseph Cali, Ed.D.
The University of Buffalo, 1959

The purpose of this study was to determine what chief school administrators think some of the behaviors are that public school administrators need to exhibit in order to operate effectively in their human relationships with teachers. One hundred ten chief school administrators of the public school systems in the eight county area of the Eighth Judicial District of Western New York State were polled.

A forced choice checklist of human relations behaviors was utilized. This checklist was developed and used in an earlier study by Anthony M. DeIulio who used teachers as a reference group. Of the one hundred ten chief school administrators polled in this study, one hundred two or 92.7% responded providing ninety-five perfect response checklists usable for analysis. Thus, the findings of this study were derived from ninety-five respondents or 86.4% of the group polled.

An information sheet developed for this study and which accompanied the checklist derived extensive personal data concerning age, educational background, extent and variety of experience in education of the respondents. In addition, data about the public school systems these chief school officers administer were also gathered. These data were gathered and analyzed in an attempt to determine whether or not significant relationships might exist between these factors and the status of opinion regarding human relations behaviors as revealed by the forced choice checklist.

The areas or major categories of human relations as defined and investigated in this study are Interpersonal Relationships; Group Dynamics; Democratic Administration; School-Community Relationships; Pupil-Centered Administration; Recognition of Individual Differences; Cultural, Ethnic Group Differences.

The forced choice checklist used contains sixty-three items which refer to the seven areas or major categories of human relations noted above. These items are stated in behavioral terms. The sixty-three items are arranged into twenty-one groups or triads of three items each. Each respondent is required, by forced choice response technique, to rank the items within each triad on the basis of his judgment of their relative importance.

Analysis of the respondents choices allowed the seven areas or major categories of human relations to be ranked according to their relative importance as judged by the respondents. Using a paired comparison technique, scale values for each of the areas were derived and the areas ranked as follows:

Democratic Administration
Group Dynamics
Interpersonal Relations
Recognition of Individual Differences
Pupil-Centered Administration
School-Community Relations
Cultural, Ethnic Group Differences

Ranking of items by scores allowed for the determination of specific behaviors seen to be most important by respondents. It was further determined that there appears to be little relationship between the type of response and the personal factors as investigated in this study. Comparison of responses and data referring to school systems indicated that those administrators who administered larger systems tended to value the Democratic Administration area consistently more highly than did those who administered smaller systems.

Implications were drawn with reference to further research, preparation programs for administration, and effective practices of public school administrators.

Microfilm $2.50; Xerox $8.60. 189 pages.

A STUDY OF THE ROLE OF THE PRINCIPAL IN COORDINATING CURRICULUM IMPROVEMENT IN THE ELEMENTARY SCHOOLS OF INDIANA

(L. C. Card No. Mic 59-4272)

William Max Clary, Ed.D.
Indiana University, 1959

Chairman: H. J. Hicks

The Problem

The purpose of the study was to examine the role the principal was playing in curriculum improvement in the elementary schools of Indiana. This study was an attempt to determine what professional efforts were underway to improve the curriculum in the individual schools in the light of selected principles that should guide a program of curriculum leadership. An attempt was made to determine the nature and extent of the principal's involvement in activities which implement basic principles of curriculum leadership.

Procedures

The following steps were used to carry this investigation to its completion:

1. The historical background of the position of elementary school principals' role in curriculum improvement and pertinent articles in periodicals, research manuscripts, and books were reviewed.
2. Literature concerned with curriculum leadership was critically read to determine commonly accepted principles that should guide curriculum leadership in elementary school.
3. A set of principles that should guide the principals in curriculum leadership was formulated. These principles were submitted to selected educators for critical review.
4. A questionnaire was sent each commissioned elementary school principal in the state of Indiana.
5. A guide sheet for personal interviews was developed to be used in verifying and supplementing the data.
6. The responses were analyzed to determine the extent to which basic principles were accepted and implemented by elementary school principals of Indiana.

Conclusions

In terms of the findings of this study regarding curriculum improvement activities of elementary school principals in the state of Indiana, it may be concluded that in most cases the following conditions exist:

1. The elementary principal has a clear responsibility for giving day-to-day leadership in curriculum improvement.
2. Only a few school systems are providing sufficient personnel to give the elementary school principal assistance in curriculum leadership.
3. Principals are making efforts to provide flexibility in the scheduling of classes and activities.
4. Principals are encouraging pupil-teacher planning.
5. Principals place great value on parent-teacher conferences.
6. Principals are encouraging teachers to join professional groups which are interested in child growth and development.
7. Studying school practices of reporting to parents occupies considerable attention of the school staff.
8. Promoting better human relations among the staff is considered one of the most vital functions which the principal may perform.
9. Helping others assume leadership in various phases of the school program is considered an effective means for improving the curriculum.
10. Little use is being made of consultants who might assist in planning workshops concerning curriculum improvements.
11. Few schools are operating a curriculum materials center.
12. Principals are involved to a great extent in orienting new teachers.
13. Very few principals are doing any professional writing or research.
14. Principals give little attention to working with teachers on classroom practices of an experimental nature.
15. Principals feel that involvement in curriculum work is a vital responsibility and, in general, desire more involvement in curriculum study and improvement.

Microfilm $2.20; Xerox $7.80. 167 pages.

THE ADMINISTRATION OF RESIDENCE HALLS AT SELECTED, COEDUCATIONAL PUBLIC UNIVERSITIES WITH PARTICULAR REFERENCE TO THE UNIVERSITY OF CONNECTICUT

(L. C. Card No. Mic 59-3835)

Sumner Maurice Cohen, Ph.D.
The University of Connecticut, 1959

Statement of Problem. The study was designed to evaluate the residence hall philosophy, organization for administration, and the policies affecting residence hall operation at the University of Connecticut in relation to current thinking and practice at other comparable institutions.

Method. In addition to a study of the literature, relevant information was requested from twenty-six selected institutions through the circulation of a questionnaire, the solicitation of informational materials and the study of their catalogs, and through a compilation of the policies and procedures related to residence hall operation at the

University of Connecticut. All but five institutions responded by returning complete or partial information.

Findings:

1. Institutions of higher education have a real and immediate need for factual information about operating policies of residence hall administration.
2. State supported coeducational institutions are expanding housing facilities for single and married students as rapidly as possible to accommodate increasing enrollments.
3. The University of Connecticut compares very favorably in its ability to house single students but suffers by comparison in its accommodations for married students.
4. Current residence hall practices fall far short of suggested educational aims at large state supported coeducational institutions and at the University of Connecticut.
5. There is considerable unanimity of opinion that a unified type of organization is necessary for the effective operation of residence halls but lack of agreement on the best design for the organization.
6. There is evidence that the larger a public coeducational university as evidenced by its undergraduate enrollment, the more likely it will have a unified type of residence hall administrative organization.
7. The University of Connecticut's administrative residence hall organization is characterized by the divided autonomous authority and responsibility found in small institutions.
8. There is no uniformity of terminology in the titles used to identify residence hall staff as there is for academic staff.
9. There is increasing emphasis on the educational role of "Heads of Residence" as reflected in the preponderance of institutions employing full-time staff with faculty or professional status in both men's and women's residences.
10. Student residence hall government is universally accepted as an essential element in the administrative organization for residence halls.
11. Residence hall operating policies at the University of Connecticut with two exceptions are substantially in agreement with current practice and thinking at other comparable institutions in that the University of Connecticut: has a formal statement of its housing policy in its catalog, uses a written contract with students in making assignments to its residence halls, permits student use of residence hall facilities in practically the same manner as do other comparable institutions, has established minimum necessary standards of conduct identical with those of other similar institutions, and has invited student government to participate in the formulation and maintenance of residence hall regulations. The University of Connecticut differs from the majority of comparable institutions in two respects: it does not require all students to board; and does not provide any item or service beyond basic equipment in student rooms.

Microfilm $2.80; Xerox $9.80. 216 pages.

IDENTIFICATION AND EXPLORATORY ANALYSIS OF THE PROBLEMS OF SELECTED COLLEGE AND UNIVERSITY PUBLIC RELATIONS DIRECTORS

(L. C. Card No. Mic 59-4000)

Robert Vroman Esmond, Ph.D.
Indiana University, 1959

The problem was to identify and analyze the problems of a selected group of college and university public relations directors in terms of (1) the specific problems facing the group and the extent to which each problem is a problem of the total group, (2) the specific problems facing directors when classified according to the enrollment, form of institutional control, and type of instructional program at the institutions with which they are affiliated, and (3) those problems which directors consider their greatest sources of difficulty.

The sample was composed of 703 persons, selected from the 1957 membership of the American College Public Relations Association, who were in charge of public relations at their institutions. Schools in every state, Alaska excepted, and the District of Columbia were represented in the sample.

The research method used was the survey, and the primary instrument was a check list developed by the author which contained 154 statements of problems the public relations director might face. A response of 79.6 per cent was obtained. Most of the data processing was done by the Research Computing Center at Indiana University.

The conclusions were as follows:

1. No single problem affects all public relations directors; relatively few affect one-fourth or more of the group. The problems directors call their "greatest sources of difficulty" result from having too much to do in too little time with too few assistants.

2. Faculty members cause more problems for public relations directors than any other group with whom the directors deal. Most often these problems stem from faculty misunderstanding of what constitutes news, from a failure to distinguish between publicity and public relations, and from a lack of knowledge of their role in public relations.

3. In general, public relations directors have few problems in their relationship with administrative officers, with the president in particular. The directors believe that they have authority to do their jobs but believe they should not be excluded from institutional policy making groups.

4. The directorship is considered a professional position by public relations directors, a position which generally carries prestige and security with it. Directors find satisfaction and challenge in their work, consider themselves part of a recognized professional group which operates according to ethical standards, and do not complain of lack of vigorous leadership from the American College Public Relations Association, the major professional organization in the field.

5. Limited PR budgets do not provide adequate professional assistance for the director who therefore has too much to do personally, adequate space for work, or a sufficient guarantee for the future to encourage PR planning on a long-range basis.

6. Regardless of the enrollment at their institutions, the type of institutional control, or the type of instructional program, the problems of public relations directors are relatively the same.

Microfilm $3.00; Xerox $10.40. 232 pages.

A STUDY OF THE WORKING PATTERNS OF THE SECONDARY SCHOOL PRINCIPALS IN A METROPOLITAN AREA AND THEIR EFFECTS ON THE OPINIONS AND ATTITUDES OF TEACHERS

(L. C. Card No. Mic 59-3972)

Charles Milne Greig, Ph.D.
University of Michigan, 1959

This study examined the working patterns of twenty-seven high school principals in Wayne County, Michigan, exclusive of Detroit, in terms of whether their behavior is basically democratic or autocratic. Then, the favorable or unfavorable attitudes and opinions of teachers under either relatively autocratic principals or relative democratic principals were investigated.

Twenty-seven high school principals of Wayne County, Michigan were the subjects of this study. From the rankings of the twenty-seven principals, based on the results obtained from The Principal Behavior Check List, the two principals with the most autocratic working patterns and the two principals with the most democratic working patterns were selected. The opinions and attitudes of the teachers in the schools of these principals were obtained by administering The Educators Opinion Inventory.

The data gathered for the study supported the three major hypotheses of the study, but supported only four of the ten minor hypotheses. Those hypotheses which were supported by the findings of this investigation were the following:

Major Hypotheses

The working patterns of the high school principals in Wayne County, Michigan, exclusive of Detroit, will tend to be more democratic than autocratic.

Principals will tend to perceive themselves as more democratic than teachers feel they are.

The opinions and attitudes of the teachers in high schools with relatively democratic principals are more favorable toward the working pattern of the principal than is the case in high schools with relatively autocratic principals.

Minor Hypotheses

There is no relation between the working demands, pay, curriculum materials, fringe benefits, and working conditions of the school in which the teacher teaches and the working pattern of the principal.

Schools with relatively democratic principals have more adequate communication than schools with relative autocratic principals.

The working pattern of the principal has no influence on the teacher's personal freedom and community relationships.

Teachers under relatively democratic principals are professionally more satisfied than those teaching under relatively autocratic principals.

The minor hypotheses not supported by the data in this study were the following:

Principals in large schools tend to be more autocratic than do principals in smaller schools.

Teachers in schools with relatively democratic principals have greater work demands than teachers with relatively autocratic principals.

Teachers in schools with relatively autocratic principals have more confidence in the administration than teachers under democratic principals.

Teachers in schools with relatively autocratic principals feel their school administrators are more effective than teachers in schools with relatively democratic principals.

Teachers in schools with relatively democratic principals are more favorable toward efforts to provide adequately for pupil individual differences than are teachers in schools with relatively autocratic principals.

Teachers in schools with relatively democratic principals have more opportunity for growth and advancement than teachers in schools with relatively autocratic principals. Microfilm $3.60; Xerox $12.20. 280 pages.

BEHAVIORAL PATTERNS OF SELECTED SUPERINTENDENTS DURING THE PROCESS OF PUBLIC SCHOOL DESEGREGATION

(L. C. Card No. Mic 59-4257)

Sam Harris Ingram, Ed.D.
The University of Tennessee, 1959

Major Professor: Galen N. Drewry

The problem of this study was to identify and describe behavioral patterns of selected public school superintendents during the process of public school desegregation. The sub-problems were (1) to identify and describe the behavior of the selected superintendents toward their administrative staffs, their school boards, their teachers, and the public, and (2) to identify and describe the general behavioral patterns of the selected superintendents during public school desegregation.

The study was limited to ten public school superintendents in Kentucky systems where some form of public school desegregation had been accomplished. These ten superintendents and the Kentucky State Department of Education had indicated a willingness to cooperate in the study.

Data for the study were collected through personal interviews with the superintendents, other school personnel, and lay citizens in each of the ten systems. The official school board minutes pertaining to public school desegregation as well as other written material coming from the superintendent's office were examined in each school system. Newspapers were examined when these were believed to have taken an active part in desegregation.

An analysis of the data revealed that there were many

factors which affected the behavior of the selected superintendents during public school desegregation. Some of the factors which seemed to affect the superintendent's behavior were: (1) tradition as revealed in the history of white and Negro education in Kentucky, (2) the legal structure within which the superintendents operated, (3) the positive reaction of the Kentucky state officials to the Supreme Court decision, (4) the number of human relations agencies operating within the state, (5) the work of the State Department of Education in Kentucky, (6) the relatively small number of Negroes in many systems, (7) the security which the superintendent felt in his position (8) the skills each superintendent possessed in affecting social change, (9) the amount of pressure placed upon the superintendents, and (10) the conditions existing in the Negro schools just prior to desegregation.

The action of each of the ten superintendents was found to fall within one of four general behavioral patterns. These four patterns of behavior were: (1) superintendents who furnished initial leadership and made careful preparation for public school desegregation, (2) superintendents who initiated action without careful planning for desegregation, (3) superintendents who waited for the community or other agencies to initiate action and then provided formal leadership in preparing for desegregation, and (4) superintendents who waited for the community or other agencies to initiate action and made little formal preparation for desegregation. Microfilm $2.45; Xerox $8.60. 187 pages.

THE CITY ELEMENTARY SCHOOL PRINCIPAL

(L. C. Card No. Mic 59-3666)

Russell Rex Kircher, Ed.D.
Stanford University, 1959

The main purpose of this study was to identify the competencies needed for the city elementary school principalship, and secondarily to identify desirable areas and experiences for preassignment and in-service training. The hypotheses were: (1) that these competencies could be derived through a study of occupational information, and (2) that some competencies were common to all principalships. It was not the purpose of this study to overlook the actuality of consensual validation, but to investigate critically the occupational information in order to determine necessary proficiencies instead of those which were continued needlessly and followed religiously because of routine practices.

Twenty-six elementary principals in the Sacramento City Unified School District were the resource persons who supplied the necessary data. A daily diary form served as the primary source of occupational information and was supplemented and clarified by interview and inspection techniques. In order to complete the diary form, all of the activities of each principal were recorded and described as to time spent, location of the activity, personnel involved, the specific activity, and the apparent or underlying cause. Two seven day sampling periods were established and entries from the diary form were classified and categorized at the end of the second sampling period. There were 4,557 entries for the two sampling periods. A comparison of the two sampling periods gave evidence of general consistency. There was no indication that any job factor, such as size of the plant and number of pupils enrolled, produced a greater or smaller number of entries. Variation seemed to be dependent upon reporting habits and personality of the principal rather than on actual differences in the type or amount of any given activity. The entries were placed in three categories: Content, Personnel and Location. Each category was then divided into eight subgroups to determine more specifically the competencies needed for effective fulfillment of the given responsibilities. The subgroups of the Content category were: Plant and Site, Administrative Management, Personal and Professional Growth, Public Relations, Personnel Administration, Instructional Leadership, Noninstructional Leadership, and Other. The Location category was divided into: Classroom, Teachers' Room, Principal's Office, Hall, and Other Rooms, Yard and Porches, Central Office, Home, and Other. The subgroups for the Personnel category were: Self, Certificated Staff, Pupil, Parent, Patron, Noncertificated Staff, Professional Groups, and Central Staff. Specific competencies in each of the three main categories were described in terms of knowledge, skill, and action pattern.

It was assumed that the principals were competent, reported reliably on the daily diary form, and that the sampling periods were adequate; therefore, specific competencies were logically inferred from a study of the principals' daily activities. It was concluded that these competencies can be identified, the knowledge and understanding needed for the job can be isolated, and the necessary skills determined, to put this knowledge into an effective pattern of operation. Identical competencies are not necessarily needed in each principalship, but there are basic competencies common to all principalships. These, however, are dynamic and everchanging. Certain specific competencies such as budget preparation, building maintenance, and attendance accounting have not been recognized in planning preassignment training; however, the field experience or internship programs may offer a more comprehensive and necessary type of training. Throughout the study there was evidence that effective communicative skills were a much needed competency for administrative leadership.

It was recommended that training institutions take an active role in the evaluation and development of effective communicative skills; that principals continuously study the principalship individually and in groups, and that additional study be directed to the analysis of the principal's work. Microfilm $2.00; Xerox $6.60. 136 pages.

KINDERGARTENS IN ALABAMA

(L. C. Card No. Mic 59-3003)

Mary Askew Layfield, Ed.D.
Alabama Polytechnic Institute, 1959

Supervisor: Raymond H. White

PURPOSE

The purposes of the study were: first, to determine the background, philosophy, and aims of kindergarten education; secondly, to determine the status of kindergartens

in Alabama; and to recommend improvements in kindergarten education in Alabama.

PROCEDURE

The investigator located kindergarten teachers in Alabama through school superintendents, personal contacts, and summer conferences. After reading and analyzing the kindergarten literature, she developed a questionnaire, which was validated by a pilot study, to secure information about Alabama kindergartens. Through summer conferences and field visits she achieved a desirable relationship with the kindergarten teachers. Of the 296 teachers in 168 schools in Alabama who were sent questionnaires 256 teachers representing 142 schools replied.

FINDINGS

1. Alabama kindergarten teachers did not meet the desirable academic requirements. Only 17.6 per cent of teachers in Alabama had four or more years of college preparation.
2. Alabama exercised no state control over the kindergartens; furthermore, 84.5 per cent of the kindergartens reported no local controls.
3. Public school administrators usually did not provide information and assistance to kindergarten teachers.
4. Most Alabama kindergartens had one of three different types of sponsorships: private individuals, industrial concerns, and churches.
5. The groups of kindergarten children in Alabama were too large. In fact, 84.4 per cent of the kindergartens enrolled more than the suggested 20 children per group.
6. Alabama kindergartens often did not provide adequate space for indoor or outdoor activities. Approximately 38 per cent reported insufficient outdoor space, and 72 per cent did not have adequate indoor space.
7. Many schools lacked equipment to stimulate dramatic play and to provide experiences with animal and plant life.
8. Many Alabama kindergartens failed to have provisions to meet the health needs of children.
9. Seventy-one and eight-tenths per cent of Alabama kindergartens had end-of-the-year programs. Usually these programs took one to two months of preparation.
10. Children in Alabama kindergartens often were engaging in art and music activities which might hinder their creativity. A majority of the schools provided color books, offered instruction in coloring within the line, and used patterns for art.

RECOMMENDATIONS

From kindergarten leaders' suggestions for kindergartens and from information obtained from the questionnaires about Alabama kindergartens, the following recommendations are made to give direction for indicated extension of kindergarten education.

1. Legal provisions should be passed to give county school systems the same rights as city systems to establish and maintain kindergartens. City school systems should exercise their legal rights to have kindergartens.
2. Money should be provided in the Minimum Foundation Program to establish and maintain public school kindergartens as a part of the elementary school.
3. The State Department of Education should assume leadership in kindergarten education. This leadership should be implemented by the necessary personnel in the State Department.
4. Certification should be set up and requirements given for kindergarten teachers by the State Board of Education.
5. State colleges should develop curriculums for the training of kindergarten teachers and provide other professional assistance.
6. Kindergarten teachers need an organization for professional growth.
7. The State Health Department should establish and enforce rules and regulations which would insure health protection of kindergarten children.
8. Present kindergartens should limit their enrollments, improve building facilities, provide experiences with plant and animal life, stimulate creative self-expression in art and music activities, and discontinue elaborate end-of-the-year programs.

Microfilm $4.05; Xerox $13.60. 315 pages.

MERIT RATING IN THE TEACHING PROFESSION, WHAT IT IS AND WHAT CAN BE DONE ABOUT IT

(L. C. Card No. Mic 59-3852)

Robert Euth Markarian, Ph.D.
The University of Connecticut, 1959

Investigation of merit rating in the teaching profession reveals that it is one of the most controversial subjects in American education. It has been the purpose of this study to determine the status of merit rating today and make recommendations for satisfactory solution of the problem. The study has been limited to compensation plans covering only the teaching staff in a typical, American public school system.

Salary development was traced historically in order to create the setting in which merit proposals are being made. This review of compensatory arrangements for teachers reveals that merit proposals are timely and appropriate, a natural development in the evolution of teacher's salaries.

The situation today is further amplified by showing the controversial nature of merit rating among prominent educators. Here points of view by experimenters and writers in education are presented to show that a case can presently be made for either side of the controversy. Three groups are identified, each with a different point of view:

School board members, who are in favor if it and see it as attainable;

Administrators, who see possibilities in it but are doubtful about implementing it for salary determination;

Teachers, who are opposed to it because they think it cannot be administered properly.

In an attempt to resolve the controversy the main body of this study examines the evidence available on merit rating. First, it is shown that differences do exist in teaching ability. Then the specific areas of controversy are presented together with the arguments used by both sides. Because of the depth of the controversy, prominent

studies and group attitudes were investigated. These include a comprehensive study by the New England School Development Council, which came out in favor of a merit plan; the National Education Association and American Federation of Teachers, both of which are unalterably opposed; professional literature, some of which favors merit rating while other accounts oppose it; professional and non-professional groups, the best of which is a review by the New York State Teachers Association. This latter group came to the conclusion that they are not yet ready to accept merit rating.

Despite the preponderance of opposition to merit rating the logical appropriateness of a sound plan persisted, and so specific school systems where merit rating is employed were investigated. These reveal a wide variety of plans, each one emphasizing a different feature such that no two are alike. Out of all the evidence thus accumulated it was decided that the principles underlying merit rating are morally and ethically right in a democratic society. It was further decided that a properly functioning plan is attainable.

To this end recommendations were made for the development of a merit salary plan. Since one generalization coming out of this study is that any plan must be geared to the local setting, it is not possible to create a blueprint which is universally applicable. All that can be done is to take the recommendations and apply them to the local situation. Then when conditions are compatible for the acceptance of merit rating, these recommendations should help to provide a base upon which teaching might be professionalized. Microfilm $2.15; Xerox $7.60. 164 pages.

DIFFERENTIAL PERCEPTIONS OF THE CRITERIA USED FOR THE SELECTION OF ADMINISTRATIVE PERSONNEL

(L. C. Card No. Mic 59-3667)

Stuart Arthur Marshall, Ed.D.
Stanford University, 1959

This study was concerned with the expansion of data brought forth by Briner,[1] and with the degree of relevance among administrative selection criteria identified by superintendents of schools, professors of educational administration, and directors of college and university placement services.

The Samples

The total sample of superintendents, four hundred twenty, was drawn from the membership roster of the American Association of School Administration by random sampling.

The samples of professors and directors, one hundred forty-one of each, were drawn by random sampling from the roster of professors of educational administration and the roster of the American Association of School Administrators.

The Instrument

A mailed survey instrument was used. It was of the pencil-and-paper variety with a cover sheet, one hundred fifty administrative selection criteria, and thirty-eight items representing gross criteria.

For the one hundred fifty criteria, each respondent was requested to circle that one of five symbols preceding each item which best indicated his feeling toward it. For the thirty-eight items at the end of the instrument, each respondent was requested to circle the one of five symbols preceding each item that best indicated its influence upon him in the selection process.

At the end of each category of items, space was provided for comments, suggestions, and additional criteria.

Treatment of Data

Responses were received from two hundred eight-two superintendents, sixty-seven per cent of the sample; from eighty-one professors, fifty-seven per cent of the sample; and seventy-six directors, fifty-four per cent of the sample.

The responses to the completed instruments were tabulated in each of the five response categories according to selection frequencies for each group and for each item. Aggregate group responses also were indicated.

The responses in the SA and A categories were combined into a common A category; those in the D and SD categories were combined into a common D category.

From the three response categories, A, U, and D, the percentage of responses in each category was calculated and recorded.

Contingency tables were constructed of the tabulation of responses in the five response categories for the superintendents and professors, for the superintendents and the directors, and the professors and directors. The chi-square test was then applied to determine the significance of the differences, if any, between the response patterns.

Each free response was listed under the item or general category to which it pertained.

Conclusions

Consideration of the data and an analysis of significant differences, ninety-one of them at the .05 to .001 levels, lead to the following conclusions:

The instrument responses of the professors and directors indicate certain significant differences between their interpretations of the use of certain administrative selection criteria by the superintendents, and the use of these criteria as reported by the superintendents.

The criteria included in the instrument appear to be relevant to the administrative selection process.

The respondents of each group appear to agree with statements in principle, but to indicate indecision or a greater diversification of attitudes in responding to statements of specific policy or procedure.

The significant differences between the responses of the superintendents and professors appear to be more prevalent in those areas of competency generally assigned the professors, i.e., administrative theory, social foundations.

The significant differences between the responses of the superintendents and directors appear to be more prevalent in those areas of competency generally assigned the directors, i.e., placement criteria and its evaluation.

Microfilm $5.20; Xerox $18.40. 406 pages.

1. Conrad Briner, "Identification and Definition of the Criteria Relevant to the Selection of Public School Administrative Personnel" (unpublished Ed.D. dissertation, Stanford University, 1958).

PEER ACCEPTANCE AND REJECTION OF NEGRO TEACHERS WHO WERE FIRST OR AMONG THE FIRST TO BE EMPLOYED IN WHITE OR PREDOMINANTLY WHITE SCHOOLS NORTH OF THE MASON-DIXON LINE

(L. C. Card No. Mic 59-3954)

Marie Davidson Rivers, Ph.D.
University of Michigan, 1959

The purpose of this study was to find out factors which make for acceptance or rejection of Negro teachers who were assigned to teach in white or predominantly white schools north of the Mason-Dixon Line. It was hoped that this investigation might help in finding solutions to the following problems incurred by the Supreme Court's decision against segregated public schools:

1. Will the Negro teacher be accepted by white co-workers, pupils, and the communities where faculty integration is initiated, on the bases of personal worth and efficiency, or will he be rejected solely because of his race?
2. What factors will influence acceptance or rejection of Negro teachers employed on integrated faculties in white or predominantly white schools?

The research procedures were as follows:

1. Locating cases of Negro teachers who were first or among the first to be employed on faculties of white or predominantly white schools north of the Mason-Dixon Line.
2. Designing interview schedules for school superintendents and principals, Negro teachers and white teachers.
3. Formation and training of an interviewing team to assist the writer in conducting interviews.
4. Obtaining data through a series of visitations and personal interviews in 13 cities of four non-southern states. Interviews were held with 19 school superintendents, a college dean, 49 principals and a total of 176 white and Negro teachers.

The general conclusions drawn from the study are:

1. Faculty integration in the 13 cities was a success on all levels and in all phases of teaching.
2. The high criteria used by school administrators for selecting the 88 Negro teachers insured the success of the initial trials of faculty integration.
3. Competent Negro teachers are not unlike competent teachers of other races in reflecting good influence in the school and the community.
4. Administrators were forthright in their praise of the high efficiency of the 88 Negro teachers and expressed a willingness to continue and extend their programs of faculty integration.
5. White co-workers accepted the 88 Negro teachers professionally and included them in all school and social activities which were conducted in the public schools investigated for the study.
6. White students reacted favorably to the Negro teachers from the very beginning. A small per cent of parents reacted unfavorably at the initial stages, but changed after having experienced faculty integration.
7. Community civic groups, real estate associations and social interest groups are strong determiners of the social acceptance of the Negro teachers who worked on integrated faculties in the communities.
8. The major issues of faculty integration seem to lie within the act itself, of employing Negro teachers for a white community, and are not those of inefficiency or lack of preparation on the part of Negro teachers.

Microfilm $3.90; Xerox $13.20. 304 pages.

AN ANALYSIS OF CRITICAL INCIDENTS IN ADMINISTRATION REPORTED AS AFFECTING PROFESSIONAL ACTIONS OF TEACHERS

(L. C. Card No. Mic 59-4281)

Maxine Hazel Robbins, Ed.D.
Indiana University, 1959

Chairman: Hanne J. Hicks

Problem

The purpose of this study was to determine how the professional actions of teachers have been affected by the administrative activities of elementary school principals. The two major aspects of the study were to identify the critical incidents which teachers felt were effective and instructive, and were an aid to teaching, and the critical incidents which were ineffective or obstructive, and served as a handicap to teachers' professional activities.

Procedures

The data were obtained by a questionnaire using the "critical incident" technique. All of the teachers in grades kindergarten through the eighth in the selected school system received questionnaires. Information on the returned questionnaires was analyzed for critical behaviors. 251 specific behaviors were abstracted and categorized into four broad areas and 26 sub-areas. A list of 25 critical requirements for a principal of an elementary school was compiled according to the frequencies with which the behaviors appeared. The personal data concerning the principals was analyzed statistically, using chi-square. The analysis fell into three phrases: (1) comparison of effective and ineffective principals with respect to background variables (2) analysis of the relationship between the type of critical behaviors reported and the background variables of the effective principals; and (3) analysis of the relationship between the types of critical behaviors reported and the background variables of the ineffective principals.

Major Findings

The following were the major findings of this study:

1. The most important area of requirement for elementary school principals, based upon the frequency classification of critical behaviors, is that of personal relationships.

2. The second area in terms of frequencies is effective actions in supplying leadership to improve instruction.

3. The third area of importance is that of effective actions which help teachers to gain classroom control.

4. Of fourth importance is the guidance and counseling which take place in the elementary schools.

5. There is a definite relationship between the age of the principal and his effectiveness as shown by the chi-square test for significance. Proportionally, there were over twice as many effective principals than ineffective principals between the ages of 41 and 50 years, and there were over twice as many ineffective as effective principals over 60 years of age.

6. Ineffective principals have more critical incidents in Area III, effectiveness in personal relations, than in any other area.

7. The chi-square test of significance indicates that ineffective principals fall short of the teacher's expectations in supplying educational leadership toward improving instruction.

8. The majority (75 per cent) of both effective and ineffective principals have a background of teaching experience in primary, intermediate, or junior high school.

9. Effective principals are more likely to have a university background in training than are ineffective principals.

10. A larger proportion of effective principals than of ineffective principals have progressed beyond the M.S. degree in their academic work.

Recommendations

In view of the findings in this study, the following recommendations seem warranted:

1. Those institutions which are responsible for educating administrators should give more attention to the development of abilities in the field of human relations.

2. Teacher educating institutions which offer graduate work should consider a revision of the work which is offered so that they could include a sixth year. Part of the six years should be an internship.

3. School boards and superintendents should develop a more uniform guide for the selection of principals, and for the recruitment of the best persons for future administrative openings. Microfilm $2.20; Xerox $7.80. 168 pages.

ESTABLISHING FUTURE SCHOOL BUILDING NEEDS IN THE INGLEWOOD, CALIFORNIA, UNIFIED SCHOOL DISTRICT

(L. C. Card No. Mic 59-3669)

Harold Trevor Santee, Ed.D.
Stanford University, 1959

Purpose of Study. This dissertation is essentially a case study of a particular community's search for a solution to its school building needs. Twice in 1957 school bond proposals had been defeated by the voters although sufficient resources were available to finance the necessary school facilities. The problem was therefore not primarily a financial one, although gaining financial support was necessary to the ultimate solution of the problem.

The primary problem was one of changing community attitudes and developing community understandings so that adequate support would be given to the request for additional funds with which to provide school facilities.

This study outlines the procedures which were followed and demonstrates how one school community reached a consensus upon a problem about which there had been intense disagreement.

Sources of Data. Data was gathered from the following sources: (1) literature in the field of survey methods and actual surveys of other school districts made by experts in the field, (2) literature in the field of group dynamics, (3) population statistics issued by various agencies including the United States Bureau of Census, (4) literature in the field of school enrollment projection, (5) literature in the field of demography, and (6) records and files of the school district used as a case study.

Findings. (1) Selection of the survey method to be used in a school district should be determined by the nature of the community to be studied. (2) It is generally desirable to take the community and the Board of Education through the thinking process of arriving at school building needs before requests for additional funds are made. (3) The study of population statistics serves to authenticate the factors used as the basis for school enrollment projections. (4) School enrollment projections are based upon many of the same factors as are general population forecasts. (5) The Master Plan for school plant needs in a district, developed by the administration on the basis of research findings, can serve as the basis for alerting the community to an understanding and acceptance of school needs. (6) Development and approval of a program for obtaining adequate school facilities by a citizens committee with broad representation from the community will tend to influence favorably many persons who might otherwise be opposed to the program.

Conclusions. It is generally held true that the passage of school bond issues is of primary importance to most school districts in California. The experience in this school district confirms the fact that the development of a Master Plan which includes a sound analysis of present plants and future enrollments is necessary. Further, it was found that wide participation, basically through a citizens committee carefully studying the problem, is an essential second step. And finally, the broad dissemination of authenticated information by the school administration, the citizens committee, and the board of education engenders community confidence in those responsible for the administration of a school district. The result of this confidence is expressed in a favorable attitude toward the problems of the schools including the need for additional funds. Microfilm $3.45; Xerox $11.60. 265 pages.

THE TORT LIABILITY STATUS OF INDIANA PUBLIC SCHOOLS AND THE CURRENT LIABILITY INSURANCE PRACTICES OF INDIANA PUBLIC SCHOOL CORPORATIONS

(L. C. Card No. Mic 59-4282)

Robert Warren Schaerer, Ed.D.
Indiana University, 1959

Chairman: W. Monfort Barr

The Problem

The purpose of this study was to provide more clear and concise answers to the questions of Indiana public school tort liability and to compare these legal findings to the current liability insurance practices of Indiana public schools to see if they were compatible.

Procedure

The laws and superior court cases pertaining to tort liability of Indiana public schools were studied, summarized, categorized and reported.

The standard type liability insurance policies which had application to school tort liability were studied, summarized, categorized and reported.

Based on the findings of the tort liability status of the Indiana public schools and the standard types of liability insurance policies which had application, a summary or survey questionnaire and 13 specific or verification questionnaires were constructed and sent to all Indiana public school corporations having a superintendent and a board of education. The responses to these questionnaires were verified, summarized and reported.

Findings

The findings in this study were:

1. The tort liability status of public schools in the United States could be categorized into three groups:

   a. Liberals, which by statutory enactment have waived their governmental immunity. They are California, Connecticut, New Jersey, New York and Washington. Wisconsin and Colorado have "safe place" statutes which sometimes permit suits against schools.

   b. Conservatives, which vigorously uphold their governmental immunity and do not permit the purchase of liability insurance. They are Alabama, Arizona and West Virginia.

   c. Compromise group, which upholds their governmental immunity but permits the purchase of liability insurance, the remaining states. To this third group, the compromise position, belongs the state of Indiana.

2. The tort liability status for Indiana public schools is:

   a. The school districts have governmental immunity except where expressly stipulated to the contrary by statute.

   b. The boards of education and their officers have governmental immunity when performing their discretionary acts within the scope of their authority.

   There is some question as to whether or not boards of education and their officers are liable or have governmental immunity when performing their ministeral acts.

   Boards of education and their officers are liable when in performing their acts they are wanton, wilful and malicious.

   c. School employees are liable for their acts.

   d. By statutory enactment, school districts are liable for injuries which occur under the workmen's compensation laws.

3. The liability insurance status of Indiana public schools is:

   a. By statutory enactment, the schools were given permission to purchase liability insurance.

   b. The schools purchased 11 different types of liability insurance policies and 12 different types of liability insurance coverages.

   c. Seventy-two per cent of all school liability insurance policies named either the school district or the board of education as the sole insured.

   d. Although the school district is held to have governmental immunity by superior courts, inferior or lower courts were permitting liability judgments to be levied against the school districts, if the boards of education permitted it by refusing to avail themselves of the defense of governmental immunity.

   e. Insurance companies were consistently making out-of-court settlements for school districts, even though the school district has governmental immunity.

   f. The frequency with which school districts have been having liability lawsuits filed against them and out-of-court liability settlements made for them has been increasing.

Conclusions

The following conclusions were drawn from the study:

1. There were three reasons given why schools purchased liability insurance even though the school district itself has governmental immunity:

   a. the moral obligation of the board of education for compensation to innocently-injured parties.

   b. the protection of school officers, appointees, agents and employees against catastrophic judgments, and

   c. for public relation purposes.

2. Indiana public schools can be held liable if they do not interpose the defense of governmental immunity.

3. Insurance companies do pay off on Indiana public school liability claims.

Microfilm $3.90; Xerox $13.20. 301 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

A FAMILY, EXPERIENTIAL, AND EDUCATIONAL BACKGROUND STUDY OF SUPERINTENDENTS OF SCHOOLS IN INDIANA AND SOME COMPARISONS WITH ELEVEN OTHER MIDWESTERN STATES

(L. C. Card No. Mic 59-4284)

Charles Lee Sharp, Ed.D.
Indiana University, 1959

Chairman: Marion A. McGhehey

The purposes of this study were to secure data relative to selected factors in the socio-economic background of Indiana superintendents of schools, to establish the experiential patterns of these superintendents, and to determine their educational backgrounds. Conclusions of the study were expected to be helpful in the selection and training of superintendents.

A questionnaire was developed and sent to all the superintendents of schools in Indiana, and to the superintendents of the 25 largest school systems in eleven other midwestern states, in order to make some comparisons. This was done under the auspices of the Indiana School Boards Association which felt that the research would be valuable.

Conclusions

From the findings in this investigation, the following major conclusions were drawn:

1. Since the mean height of 7,389 males entering college in 1929 was five feet eight and five-tenths inches, and the mean height of superintendents of schools was five feet ten and three-tenths inches, it can be concluded that superintendents were taller than the mean of college men of about the same age.

2. Business and professional men were fathers of 41.3 per cent of the superintendents. Since these two groups do not constitute 41.3 per cent of the total population it can be concluded that superintendents came from predominantly middle-class families.

Sixty-eight per cent of the superintendents were Masons. Masons are considered to come from largely middle-class families. This fact again adds weight to the evidence that superintendents come from middle-class families.

3. It can be concluded that southern Indiana furnished a greater percentage of the superintendents in Indiana than could be expected in terms of the distribution of population within the state.

4. Since most of the Indiana superintendents were born in Indiana, educated in Indiana, and were serving within 100 miles of their places of birth, it can be concluded that the mobility of superintendents is relatively low.

5. Since only one superintendent of schools in Indiana was affiliated with any church other than a Protestant church, it can be concluded that it has been almost impossible for anyone of any faith other than Protestant to become a superintendent of schools in Indiana.

6. It can be concluded that opportunities for advancement to a larger superintendency are very limited due to the fact that most superintendents did not become superintendents until they were about 45 years of age. Other contributing factors included the fact that boards of education have usually filled vacancies with superintendents without prior experience as superintendents. There are always more small superintendents which means that relatively few opportunities to move to larger school corporations have been available.

Implications

Indiana superintendents are largely native-born Hoosiers, serving in the vicinity of their birthplace. They have been educated in Indiana public schools, colleges, and universities. This implies that Indiana colleges and universities have a major responsibility in training superintendents and that they can be trained rather specifically for Indiana positions.

Guidance should be given to those who appear to have the personal qualifications for a superintendency. Those who do not should be directed into some field of study for which they are qualified.

Attention should be given to the possibilities of an educational internship for superintendents of schools.

Microfilm $2.00; Xerox $5.00. 98 pages.

CRUCIAL ISSUES IN SCHOOL ADMINISTRATION: CASE STUDY OF A SUPERINTENDENT

(L. C. Card No. Mic 59-3673)

Wayne Leslie Sorenson, Ed.D.
Stanford University, 1959

This study traces the professional career of Wesley C. Hiller* while he served as superintendent of schools in Mount Monroe. This service extended over a period of nearly twenty-four years, from 1921 until his death, while in office, in 1945.

The study of selected situational aspects in his career represents a case study of unique administrative behavior conditioned by the interacting factors of the job, the man, and the situation. Also, an important segment of the educational history of the Mount Monroe School District has been interwoven in the twenty-four year period covered by the administration of Hiller.

Drawing upon the situational analysis framework, the crucial issues of educational leadership are examined in one specific setting. This approach is taken partly to test the validity of the conceptual framework used in the analysis and partly to illuminate for the administrative trainee and beginning practitioner the details and style of a specific case of educational leadership that may be considered to have been successful, as judged by the criteria of longevity and prominence.

Procedures

Personal interviews with one-hundred and four individuals who possessed pertinent information concerning Hiller's operation and administrative behavior constitute the basic data of this study. This is supplemented by information from the Minutes of the Board of Education, newspaper files, material from the files of Mount Monroe City Schools, city government offices, Chamber of Commerce, and the personal files of Hiller.

Interviews were held with representatives from the following groups: board members, school administrators, teachers, other school employees, city or government

offices, college or university instructors, newspapermen, members of the community, and book salesmen.

Principal Characteristics of Hiller's Administration

Evidence suggests that Hiller was a shrewd and brilliant man. He was a keen student of the psychology of human relations. He possessed exceptional ability to apply this knowledge in analyzing a problem situation and in making quick and accurate evaluations concerning people. He had a phenomenal memory for faces, names, and basic facts concerning many subjects. He possessed a sense of humor, constancy of mood, stability of emotion, and seemingly unlimited reserves of energy and drive.

He expressed a love for children and youth. His constant effort to better their educational, social, and recreational opportunities were attested to by his affiliation and active support in numerous organizations working toward the attainment of these humanitarian objectives.

Competency in public relations and skill as a businessman were perceived as Hiller's greatest strengths by board members and by school administrators interviewed. Teachers emphasized the public relations factor.

He recognized the power structure of the community and directed his efforts toward becoming accepted and understood by those making decisions affecting the educational program.

Weaknesses in Hiller's administrative behavior as depicted by interviewees were: (1) he liked to be in the limelight and had a tendency to steal the show from board members and fellow administrators; (2) he was reluctant to delegate authority; (3) he disliked being shown that he had made mistakes in presenting factual material or in reaching decisions; and (4) he was unnecessarily abrupt in terminating interviews and conferences.

The years 1937 to 1945 were years of controversy in Hiller's career. The major factor contributing to this was his lack of decisive leadership in the curriculum development program. His greater concern for the business and public relations aspect, and his delegation of curriculum matters to others, brought the strongest and most consistent criticism from school patrons, teachers, and administrators. Microfilm $3.55; Xerox $12.00. 274 pages.

*This is a pseudonym, as are all names of people and places used in this study. However, this study describes and analyzes a person in the role of a superintendent of schools in a specific situation; only identifying names are changed.

THE DEVELOPMENT OF THE PUBLIC ELEMENTARY SCHOOL PRINCIPALSHIP IN VIRGINIA

(L. C. Card No. Mic 59-4252)

Henry Lee Sublett, Jr., Ed.D.
University of Virginia, 1959

The purpose of this study was (1) to examine the background of the elementary principalship in Virginia and to report its growth from 1870 to the middle of the twentieth century; (2) to collect data concerning the status of the principalship in Virginia in 1957; (3) to show the development of the various areas of the principalship in Virginia; and (4) to recommend improvements for the principalship based on the findings of the study.

The study was limited to principals of white elementary schools with five or more teachers, as listed in the Virginia State Department of Education Educational Directory of 1956.

Data concerning the status of the principalship in 1957 were gathered by a questionnaire which asked for information about socio-economic status, educational preparation and experience, and type of school administered. The questionnaire also investigated problems of the position, distribution of time, and administrative relationships. The opinion of the respondent was requested concerning compulsory qualifications for the elementary principalship.

The questionnaire was completed by 522 Virginia elementary principals. This number was 82.3 per cent of the total number of principals eligible for the study. The responses represented 94 of the 99 counties and all of the 32 cities listed in the Virginia State Department of Education Educational Directory of 1956.

A brief statement of the development of education in Virginia prior to 1870 is presented. The growth of the principalship from 1870 to 1900 is traced through the beginning of the graded school plan and the rapid development of the public school system. In 1900 the typical principal of a graded school was a male who administered a school with two teachers and an enrollment between 50 and 99. Schools were in session usually five or six months per year. Literature and the results of various studies of the elementary principalship in Virginia through the years from 1900 to the middle of the twentieth century show slow but steady progress in the development of the principalship. In 1957 the typical Virginia elementary principal was a married man between the ages of 45 and 55 and a parent. The median salary of the principals reporting in 1957 was between $4000 and $4999. More than nine-tenths of the principals held the bachelor's degree; 70 per cent had done some graduate work and slightly more than half of the principals had earned a master's degree. The typical elementary principal of Virginia schools in 1957 had entered the principalship from an elementary school teaching position. A majority of the principals participating in the study administered schools with more than four hundred pupils and ten or more teachers. More than a third of the principals were employed twelve months a year; only 12.6 per cent were employed less than ten months a year. More than two-thirds of the principals did not have teaching duties and had at least part-time clerical assistance.

Recommendations for improvement of the Virginia elementary principalship, based on the findings of the study, were made with respect to the establishment of compulsory qualifications for elementary principals in Virginia and the encouragement of the continued improvement of principals' educational qualifications through practical help. Increasing the membership of principals in the Department of Elementary School Principals of the Virginia Education Association was urged. Recommendations were also made regarding the raising of principals' salaries, the provision of adequate clerical assistance for principals, and the relief of principals from teaching duties.

Microfilm $4.30; Xerox $14.20. 326 pages.

THE DEVELOPMENT OF HYPOTHESES FROM A THEORETICAL FRAMEWORK AND A TEST OF CERTAIN OF THEM CONCERNING IDIOGRAPHIC AND NOMOTHETIC LEADERS' PERCEPTIONS OF SUBORDINATES

(L. C. Card No. Mic 59-3647)

Donald J. Willower, Ed.D.
The University of Buffalo, 1959

Purpose

The purpose of the study was, (1) to develop a series of related hypotheses from a theoretical framework and, (2) to test certain of these hypotheses empirically.

The Theoretical Framework

The theoretical framework used was formulated by Getzels and Guba. It analyzes the administrative process in terms of a hierarchical setting of related roles within a social system and posits nomothetic or normative and idiographic or personal dimensions of behavior.

Three leadership styles may be derived. The nomothetic style emphasizes institutional requirements and conformity to detailed role expectations. The idiographic style emphasizes the requirements of the individual personality and minimizes role expectations. An intermediate style, the transactional, was omitted in the present study.

Application of Criteria for Adequate Theory

To provide some justification for the use of the theoretical framework, it was examined in terms of the following criteria; testability, consistency, scope, predictive power, fruitfulness and parsimony.

Development of Hypotheses

A number of hypotheses derived from the Getzels and Guba framework were presented. Most concerned hypothesized variations related to the idiographic and nomothetic leadership styles.

Methodology

The hypotheses guiding the research phase of the study were:

1. Administrators employing an idiographic leadership style will tend to regard subordinates as professionals to a greater extent than will administrators employing a nomothetic leadership style.
2. Principals employing an idiographic leadership style will tend to regard teachers as professionals to a greater extent than will principals employing a nomothetic leadership style.

The specific empirical operations carried out involved hypothesis two. Measures were required of (1) nomothetic and idiographic leadership styles and, (2) principals' perceptions of teacher professionalism.

Leadership styles.--A description of each leadership style was developed from the definitional elements of each style. Validating procedures involved the judgments of a panel as to whether the descriptions accurately reflected the definitions, and teacher classifications of the leadership styles of certain principals previously classified by their chief school administrators. The style descriptions appeared to be sufficiently useful devices upon which to base the selection of "idiographic" and "nomothetic" principals.

Professionalism.--From a previous study of professional teacher characteristics, forty items were developed which could be responded to by principals and scored as a measure of the extent to which teachers were regarded as professionals or persons having technical competence and internalized high standards of occupational performance. Preliminary procedures included piloting, the use of judges, a split-half reliability check, and interviews utilizing questions adapted from the items mentioned.

The sample.--Chief school administrators in four western New York counties, in districts having two or more full time principals, classified their principals. One city district did not participate.

These forty-one chief school administrators classified sixty-six principals as idiographic, forty-three as nomothetic and 125 as neither.

Principals classified as idiographic or nomothetic were asked to respond to the professionalism instrument. Usable returns totaled fifty-eight or 87.9 per cent from the idiographic principals and thirty-four or 79.1 per cent from the nomothetic principals.

Responding nomothetic principals were slightly older, included higher percentages of females and secondary school administrators, headed larger schools, and were more experienced than the idiographic principals.

Results

Mean scores on the professionalism instrument differed for the idiographic and nomothetic groups in the predicted direction. By t-test, this difference was significant at the .01 level, confirming hypothesis two for the present sample and providing incomplete evidence which suggests that hypothesis one may be tenable.

Mean scores were reported for each group by nine selected population characteristics. Characteristics of deviant cases were also noted.

Implications were drawn for methodology, training and practice, theory and further research.

Microfilm $2.00; Xerox $5.60. 113 pages.

ANALYSIS OF FUNCTIONS PERFORMED IN OPERATING A LOCAL PROGRAM OF VOCATIONAL AND PRACTICAL ARTS EDUCATION IN INDIANA

(L. C. Card No. Mic 59-4287)

Lewis W. Yoho, Ed.D.
Indiana University, 1959

Chairman: H. Robert Kinker

Statement of the Problem

The study was concerned with analyzing the functions performed in operating a local program of vocational and practical arts education in Indiana. Three major aspects of this program were: (1) determination of the patterns

and structures of organization which influenced function of operation; (2) determination of lines of responsibility for specific situations as well as the identification of the more operational practices which influenced functions; and (3) determination of patterns of action in crucial or potentially crucial situations.

Procedures

An interview guide data form was developed and tested for practical use by try-out interviews in a neighboring state.

The official State Department directory of local administrators of vocational and practical arts education and vocational teacher trainers included officials from 33 communities. The top vocational administrator for each of the 33 communities and the seven teacher trainers were chosen as the total population for the study.

The communities were analyzed under the following three categories: (1) communities having two or more full-time administrative or supervisory officials for vocational and practical arts education, (2) communities having one or more but less than two officials; and (3) communities having part-time officials.

Summary of Findings and Conclusions

Organizational structure. Local administrators of vocational and practical arts education were employed under various titles, generally for 11 or 12 months per year, and were working over 48 hours per week, yet they needed more assistants. Adult programs claimed 64 per cent of their responsibilities in the larger communities, 50 per cent in mid-sized and 41 per cent in smaller communities. The ratio of teachers to supervisors averaged 24:1 for larger communities; 28.1 for mid-sized and 9:1 for smaller communities; the percentage of vocational teachers in each community group was 50 per cent, 39 per cent and 28 per cent, respectively.

The local directors generally reported directly to the superintendents, but no consistent pattern of relationship to high school principals was evident. Using salary levels as indirect measures of responsibility and authority, superintendents generally placed high school principals above the vocational and practical arts administrators, but general education directors were placed somewhat below them.

Operational relationships. The selection of categories for analysis exposed considerable differences among the community groups in the importance of functions and in the means of performing them.

Activities of greatest importance to the functions of program direction, promotion, fiscal controls, facilities, equipment, supplies, integration with the total program, student personnel, supervision and coordination included, respectively, program evaluations and participation in professional conferences; consistent advertising and interpretation through direct communication; recommending and administering budgets; development of guides and standards; regular inventories for evaluation of equipment; purchasing and disbursement of supplies; writing program and course descriptions; placement of students; staff meetings, conferences and observations; and consultation with key people in industrial plants.

Field research and experimentation held little importance in program development and improvement.

Crucial or potentially crucial situations. All of the selected crucial or potentially crucial situations existed to some extent among the 33 communities but were more prevalent in the larger communities. The situations of most frequent occurrence were those involving non-vocational students enrolled with vocational students in both secondary and adult classes.

Many possibilities for counteracting the crucial situations were revealed but action indicated diversity rather than general agreement. Responses apparently followed a more basic pattern for operation than did the responses for operational functions.

Corrective action tended toward cooperative participation of all school officials and emphasized the importance of written policies and guides. Teacher trainers emphasized such action to much greater extent than did the local directors. Microfilm $3.70; Xerox $12.60. 288 pages.

EDUCATION, ADULT

ASPIRATIONAL FULFILLMENT AMONG ADULTS ON LOWER SOCIO-ECONOMIC LEVELS WITH IMPLICATIONS FOR ADULT EDUCATION

(L. C. Card No. Mic 59-4269)

Arthur Carl Burman, Ed.D.
Indiana University, 1959

Chairman: Paul E. Bergevin

The purpose of the study was to obtain information about personal concerns of adults on lower socio-economic levels by discovering what their aspirations are, what difficulties they recognize in aspirational fulfillment, and what opportunities they desire for achieving their aspirations. The findings were then analyzed to ascertain implications for adult education.

A survey was made by means of personal interviews with a controlled sample of an urban census tract population. United States census data established the tract population as being on lower socio-economic levels. Twenty-five women and twenty-five men comprised the sample.

Responses were subsequently classified into categories. The categories comprised eight areas of aspirations, four general sources of difficulties, and four basic types of opportunities. The classification of each response was determined by the combined judgments of five qualified persons.

The general findings were as follows:

1. The major interest of the adults who were surveyed was attaining a higher standard of material existence as determined by their aspirations.
2. Interest in intellectual development was virtually nonexistent although some interest in vocational training was evident.
3. Personal inadequacies of a non-physical nature and socio-economic conditions were referred to most frequently as difficulties in aspirational fulfillment.

4. Approximately a third of the sample identified educational deficiencies as difficulties.
5. Additional social opportunities were desired by the largest number of persons.
6. Relatively few persons used specific terms in describing opportunities which they desired.
7. Responses which referred to desired opportunities indicated a general absence of concrete plans for attaining aspirations.

The following major conclusions were derived from the findings:

1. The development of broad educational interests is apparently preceded by the satisfaction of needs basic to life.
2. The persons interviewed for this study exhibit a tendency to rely primarily on external forces to shape their lives.
3. The restricted educational participation is the partial result of the absence of perceived relationships between recognized hindrances to aspirational fulfillment and educational deficiencies.
4. A majority of adults residing in this urban census tract are not likely to become participants in present educational programs during the immediate future.
5. Direct educational approaches are not likely to elicit widespread participation among the population of this urban census tract.
6. A limited number of adults in the tract population are immediate prospects for adult education.
7. Vocational training programs appear to have good future possibilities for engaging many of these adults in educational experiences.
8. The fundamental task confronting educational agencies serving adults in the tract population is discovering means for engaging them in experiences by which they might develop new interests, recognize educational needs, and accept continued education as a means for personal achievement.
9. An immediate possibility for engaging some adults from the tract population in educational experiences appears to be through small, informal, social groups.

Some recommendations made as a result of the investigations were as follows:

1. Educational agencies serving the population of this urban census tract should conduct comprehensive evaluations of present programs to determine their relevancy to the concerns of these people.
2. Immediate consideration should be given by educational agencies to establishing wider personal contact among all segments of the population.
3. Educational agencies serving the adult population of the census tract should provide experimental opportunities for interested persons to cooperatively identify mutual interests and needs and after dealing with needs symptomatic in nature, proceed to real needs.
4. Educational agencies serving this adult population should explore possibilities for jointly undertaking experimental ventures involving informal social groups. Microfilm $2.75; Xerox $9.40. 210 pages.

AN ANALYSIS OF ADULT INTERPRETATION OF SIGHT AND SOUND IMPRESSIONS AND THEIR APPLICATION TO THE MEDIUM OF TELEVISION

(L. C. Card No. Mic 59-2652)

William Henry Tomlinson, Ph.D.
Michigan State University, 1958

Major Professor: Dr. Harold J. Dillon

Sight and sound impressions may be transmitted over television at different levels of comprehension. The televiewer perceives these impressions at different comprehensible levels, because of divergent backgrounds, previous experiences, educational activities, emotional influences, etc. Because of these basic concepts, this study investigated the areas which might contribute toward more effective communication through pictures and sound.

To carry out this investigation, the closed-circuit television facilities of Michigan State University were employed for a period of four evenings. During this time a heterogeneous cross-section comprising seventy-two adults from the local adult education program, university students and citizens of the community were participants in the experiment.

Each evening four sight and/or sound impressions (pictures) were transmitted over the system, with adequate pause after each exposure to allow for immediate, written descriptions of what had been seen/heard. Each image represented a complete picture category. In order to ascertain that each picture category was treated in the same manner, the sequence of picture and the treatment of sound (or lack thereof) were varied each evening.

The sound impressions (audio) were written in two different styles, popular and learned, according to composite forms derived from previous studies. Pilot study reports involving many people determined the final verbal descriptions and appropriate pictures which were selected.

The following relationships were tested during the experiment.

1. How adults interpret what they see/hear when a single visual image:

   a Appears on the television screen unaccompanied by aural description and the viewer must interpret from the picture only.

   b. Appears on the television screen accompanied by a description written in the popular style and pertinent to the picture.

   c. Appears on the television screen accompanied by a description written in the learned style and pertinent to the picture.

   d. The visual impression which is pertinent to one of the four picture categories is absent from the television screen and is heard as a description in the popular style.

2. How adults attempt to explain the significance of facts which do not explain themselves, i.e. a comparison of what may be objectively observed in a picture with what is "read into" a picture through what the viewer "thinks" he has seen.

The following are the results of the experiment, based upon both individual and group analysis:

1. The sight impressions of television are, for the most part, reinforced by the supplementary sounds of television.
2. Those sight impressions which require the least amount of explanation in the form of verbal supplement approach the level of literal representation.
3. Those sight impressions which require the greatest amount of explanation in the form of verbal supplement approach the level of enigmatic meaning.
4. The sound impressions of television are, for the most part, made more meaningful by the addition of pictures.
5. Sound impressions written in the popular style make the interpretation of most categories of pictures more meaningful.
6. Sound impressions written in the learned style retard the interpretation of most categories of pictures and seem to make them less meaningful.

Microfilm $4.75; Xerox $15.80. 369 pages.

EDUCATION, HISTORY

THE ROLE OF DANIEL COIT GILMAN IN AMERICAN GRADUATE EDUCATION

(L. C. Card No. Mic 59-1934)

Francesco Madorma Cordasco, Ed.D.
New York University, 1959

The aim of the present study has been to place Daniel Coit Gilman (1831-1908) in the historical framework of the development of graduate education in the United States. Although Gilman's importance in the history of graduate education is usually acknowledge in a few lines in the general histories of American education, this study attempts the first comprehensive study of Gilman giving historical dimension to all his educational service including his presidency of the Johns Hopkins University, 1876-1902.

The efforts in ante-bellum America to establish universities which provided in some way for graduate work fall into three classes. The first of these imagined the university to be a repository of all knowledge; the second held that the university consisted of an undergraduate college to which were added distinct graduate schools; and the third proposed that the university could be achieved in America by expanding the subject matter of the liberal arts course and by loosening up the machinery of instruction. Gilman subscribed to the second of these proposals.

Following an educational sojourn in Europe, Gilman was connected as librarian and professor at Yale College between 1855 and 1872. At Yale College Gilman advocated the super-imposition of a graduate school on the traditional liberal-arts college. In the Sheffield Scientific School of Yale College Gilman, with the other professors, instituted a carefully defined Ph.D., and in conjunction with the degree a complimentary "group system of studies" at the undergraduate level. The development of the graduate school at Yale College and the further effort of Gilman were arrested by the conservatism of Noah Porter who became Yale's eleventh president in 1871.

After several invitations, Gilman chose to accept the presidency of the University of California in 1872. In a brief tenure (1872-1875) Gilman organized at Berkeley several undergraduate colleges and provided for graduate and professional schools. However, his efforts were impeded by those factions which wanted the university to develop along the lines of a mechanic-arts college. Gilman decided to resign from the presidency of the University of California in 1875, and in the same year accepted the presidency of the proposed Johns Hopkins University which was to be founded in Baltimore.

Gilman had been the unanimous choice of the Hopkins Trustees and he encountered no difficulties in implementing his philosophy of graduate education. Thus, the Johns Hopkins University opened its doors in 1876 as an undergraduate college with an attached graduate school and with provisions for future professional schools. Starting with the nucleus of a highly trained graduate faculty, Gilman instituted a Hopkins Ph.D. largely modeled on the doctorate instituted at Yale College some decades earlier. He provided for graduate fellowships, visiting lecturers, and the publication of scholarly journals -- all of which assured the graduate program's success. The seminar, in a manner fashioned after the German seminarium, was fitted to the individual needs of various graduate departments. The "group system of studies" largely dominated an undergraduate college whose main function was to supply the graduate school a reservoir of trained talent. Following his retirement from Johns Hopkins in 1902, Gilman briefly acted as president of the newly founded Carnegie Institution where he attempted to organize a quasi-national research institute as an adjunct to the American graduate school.

Gilman has been widely acknowledged as a major influence on the development of graduate education in America. His importance has been acclaimed by leaders of both old and new academic institutions. Johns Hopkins University fulfilled a half-century of American graduate aspiration; essentially, it was the culmination of a long, indigenous educational evolution. If the German Wissenschaftslehre, the history of whose influence on American education remains to be written, had any influence on Gilman and his Hopkins, it was mainly subordinate to native impulses. Microfilm $3.80; Xerox $12.80. 293 pages.

THE LIFE AND ADMINISTRATION OF REAUMUR COLEMAN STEARNES

(L. C. Card No. Mic 59-4236)

Vearl G. McBride, Ph.D.
University of Virginia, 1959

History often has a way of eluding the researcher, resulting, at times, in an incomplete or biased array of evidence. The false picture thus presented is oft and again repeated until the panorama of events has been distorted, and justice demands a close and impartial review of the factual material.

Such is the case of Dr. Reaumur Coleman Stearnes, former Virginia educator, lawyer, and writer. He served the State of Virginia in many capacities, viz.: As Division Superintendent of Schools of Roanoke; as Secretary to the State Board of Education and quasi-Assistant State School Superintendent, and later as State Superintendent of Public Instruction. These are a few of the more important positions which he held during his more than a quarter of a century of service to his state.

Because of his long and active service in the cause of education in Virginia and the changes which he brought about there, and because of the stormy and somewhat bitter years of his incumbency as chief State educational leader, the writer is of the opinion that a record of his life and contributions to public education in the Old Dominion would be of value to students interested in the development of its public school system.

The writer was fortunate in finding that certain close relatives and acquaintances of Dr. Stearnes were still living. Many of these the writer sought out and interviewed either orally or through written correspondence.

The University of Virginia afforded the opportunity to peruse the personal and political papers of the subject and provided an excellent source of information for this study. Additional information was gained from books, newspapers, and periodicals.

Mr. Stearnes was born in Dublin, Virginia on April 8, 1866. He was reared and educated in his native state, and graduated with high honors from Richmond College (now the University of Richmond). After serving as a teacher for three years following his graduation, he was elected to serve on the Roanoke County Board of Education, and a short time later was selected as Division Superintendent of that county. He served in this capacity for fourteen years (1892-1906), when he was asked to take the position as Secretary to the State Board of Education and unofficial Assistant to the Superintendent of Public Instruction, Mr. Joseph D. Eggleston, Jr.. When the latter resigned his position in December, 1912, Mr. Stearnes was unanimously elected by the State Board of Education to succeed Mr. Eggleston. As State Superintendent, he was able to effect needed legislation for the benefit of the schools, raise the standards of teaching, and in many ways brought about an upward swing in educational thinking on the part of the public. His efforts, however, were not always approved by his colleagues and opponents. Bitter strife sometimes raged among the leaders shaping the policies of the State educational system. The strife extended to the general election of 1917 when Mr. Stearnes lost to his opponent, Mr. Harris Hart.

Mr. Stearnes felt that the actions which he took on certain issues had been misconstrued and that he had been grossly misjudged on several occasions. His withdrawal from the field of education for a time was, at least in part, the result of his unsuccessful efforts at securing a position of some standing in his chosen field in Virginia.

At the expiration of his term of office in 1917, Mr. Stearnes entered the War Camp Community Service in his native state and in other southern states. He served in this organization until 1922 when he decided to resume his formal schooling. He entered Columbia University on a part time basis, teaching, in the meantime, in night schools connected with the university and with the Y.M.C.A. He received his M.A. degree from Columbia University in 1925, and continued his teaching, devoting his full time to the schools in which he was employed. In 1929 he entered New York University, from which he graduated in 1936 with a Ph.D degree in mathematics. He was then seventy years of age. He had been teaching mathematics in New York University and continued to do so until 1937, when he was retired. He was engaged in tutoring from then until his death on May 25, 1945.

Shortly after his marriage to Miss Mary Arnold in 1888, Mr. Stearnes began the study of law and in 1892 passed the Virginia Bar examination. His law practice was of secondary concern with him, although it resulted in some remuneration for him.

A study of the life and accomplishments of Reaumur Coleman Stearnes has convinced the writer that the subject's works are of lasting value and worthy of close consideration. This man's endeavors were not always appreciated or fully understood and at times the value of his works has even been denied. As was shown in this study, however, the development of education in Virginia was greatly influenced by Mr. Stearnes' outstanding ability and devotion to his life's work. His record speaks for itself.

Microfilm $6.60; Xerox $22.80. 519 pages.

DEVELOPMENT OF VOCATIONAL AGRICULTURAL EDUCATION IN LOUISIANA

(L. C. Card No. Mic 59-3081)

John H. Mitchell, Ph.D.
Louisiana State University, 1959

Supervisor: Dr. Morris N. Abrams

This study concerns the development of vocational agricultural education in Louisiana--a period extending from the year 1917 through the year 1958. An extensive study of the pre-vocational agricultural education period, from 1908 to 1917, was conducted. The study is developed around the major components of the vocational agricultural education program, including: the all-day program, state F.F.A. association, adult education, teacher training, administration, and supervision.

A study was conducted of each area comprising the total program to determine the evolvement of each in relation to the development of vocational agricultural education in Louisiana.

An historical approach was employed in the development of the study. Many of the accessible publications and reports and other sources of data pertaining to vocational agricultural education were studied with the view of analyzing and recording the date pertinent to the study. Interviews were held between the writer and some of the early leaders in the program, which contributes to the validity of the study.

Louisiana's leaders in education were cognizant of the need for education in agriculture at the turn of the century and shortly thereafter inaugurated the teaching of agriculture in some of the elementary schools of the state. It was anticipated by these leaders that by the addition of agriculture to the curricula the economy of the state would be augumented, boys would be led into industrious habits, and the schools would be connected to practical life. Other factors responsible for the addition of agriculture to the

schools curricula were: The trend toward agricultural education in schools in the eastern and northern states--which trend spread to Louisiana, the desire on the part of many school officials to reduce drop-outs by introducing attractive courses, the desire to improve agricultural information in the public schools, and the desire to apply the educational philosophy that the main function of the public schools was to meet the needs of the masses who were not going to college.

In 1908 the Legislature of Louisiana passed a law for the encouragement of agricultural teaching in the high schools and voted $500.00 to each school maintaining a course in agriculture approved by the State Board of Education. During 1908-1909 there were seven agricultural high schools in Louisiana, although the actual addition of agriculture to the public school curricula in Louisiana was not provided for legally until passage of Act 306 of 1910. In 1910 the General Assembly appropriated $25,000.00 annually for two years to be used in establishing agricultural departments in the secondary schools of the state.

The corn club movement in Louisiana, initiated in 1908 by V. L. Roy of Avoyelles Parish, influenced the subsequent teaching of agriculture in the schools of Louisiana.

The number of agricultural departments has increased from 13 in 1917 to 233 in 1957-1958.

Progress and improvement have prevailed throughout the development of the agricultural education program in Louisiana. Some of the practices in the development of the program indicating expansion and progress include: The practice of improved teacher qualifications, building courses of study to meet the needs of student, development by teachers of annual and long-time teaching plans, increase in curricula offerings, improved teaching methods, adequate supervision of the program, providing educational programs for adult and young farmers, and the organization of the state F.F.A. association.

The supervision of the program is the responsibility of the area supervisors in the State Department of Education, under the direction of the State Supervisor.

The active participation of the Future Farmers of America members in many activities at the local, state, and national level has brought recognition to the F.F.A. and to the total vocational agricultural education program.

Teachers of vocational agriculture are trained at two teacher training institutions in the state, which provide an adequate number of well trained teachers for the state's program.

The vocational agricultural education program is administered by the local school boards in conformity with the State Plan, as developed by the State Board of Education and approved by the United States Office of Education.

Microfilm $6.05; Xerox $21.20. 476 pages.

HERBERT HOOVER AND EDUCATION

(L. C Card No. Mic 59-3668)

Raymond Henry Muessig, Ed.D.
Stanford University, 1959

Adviser: Dr. Richard E. Gross

This study is an educational, historical, and social philosophical analysis of Herbert Clark Hoover's educational experiences, views, and contributions. Data in this study are limited to published materials such as speeches, letters, interviews, articles in periodicals, reports, and books.

This dissertation includes only those incidents in Hoover's life which vitalize the zeitgeist that shaped his relationship to education. Among the persons who were influential in shaping Hoover's educational life and views, this study discusses Hoover's mother, his school teacher in Iowa, his uncle in Newberg, Oregon, a Newberg Sunday school teacher, a Salem, Oregon business college teacher, a traveling engineer, and two Stanford University professors. Other educational experiences and influences in Hoover's life include his continued individual study; research in archeology, geology, economics, and history; lecturing at Stanford University and Columbia University; writing a mining engineering text; translating a medieval mining treatise with Mrs. Hoover; initiating a project for the building of the Stanford Union; repatriating stranded American teachers at the outbreak of World War I; and food relief work for children in war-ravaged countries. When Hoover was Secretary of Commerce, he strongly opposed child labor, encouraged improved vocational education, worked toward protecting the educational potentialities of radio in its infancy, and engaged in activities of the American Child Health Association. While President, Hoover encouraged Latin-American countries in their efforts to improve education, secured funds for a school and a teacher to provide education for children in the Blue Ridge Mountains of Virginia, appointed various committees to study education and social trends, called the White House Conference on Child Health and Protection, worked for increased adult literacy, and tried to help education hold its ground during the Great Depression. As a senior citizen-advisor, Hoover has served as a trustee for various educational institutions, worked for youth organizations, and engaged in various other activities involving education.

This study devotes an entire chapter to Hoover's thoughts on education. The development of that chapter proceeds through Hoover's general frame of reference to a discussion of his social philosophy and then to a presentation and analysis of his views on specific educational issues. In general, Hoover falls closer to occupying a modal position in his general frame of reference than an extreme polar position. He could be described as a scientific-humanist, a pragmatic-idealist, or a liberal-conservative. In the analysis of Hoover's social philosophy, respect for the individual, leadership, freedom equality of opportunity, fraternity, and security are ideological issues which are treated. Hoover's views on specific educational issues like the aims of education, higher education, vocational education, and federal aid to education are also presented and analyzed.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

This study deals with only those contributions to education which are clearly direct products of Hoover's endeavors. These include the Hoover Institution on War, Revolution, and Peace, the Belgian-American Educational Foundation, health education, the National Advisory Committee on Education, the Research Committee on Social Trends, the White House Conference on Child Health and Protection, the "Children's Charter," and the Citizen's Conference on the Crisis in Education.

This study draws the conclusion that Hoover's major contributions to education have been administrative in nature. He is a man who can initiate action, organize projects, gather funds, and serve as an advisor. His claim to recognition in education lies in this administrative ability coupled with the desire to serve mankind.

Microfilm $2.90; Xerox $10.00. 221 pages.

EDITORIAL ATTITUDES OF THE MAJOR BUFFALO ENGLISH LANGUAGE NEWSPAPERS TOWARD PUBLIC EDUCATION: 1926-1950

(L. C. Card No. Mic 59-3646)

Gerald R. O'Donnell, Ed.D.
The University of Buffalo, 1959

Purpose

The purpose of this study was (1) to identify the editorial attitudes of the major Buffalo English language newspapers toward public education for the years 1926 through 1950 as indicated by the nature and volume of editorial reference and (2) to check public printed reaction to this comment through the "Letters to the Editor." To achieve this, answers to three major and five minor questions were sought.

Methodology

Selection of Papers and Time Span. The three papers chosen, The Buffalo Courier-Express, The Buffalo Evening News and The Buffalo Times, represented a substantial majority of the daily press in Buffalo. The time span of twenty-five years provided an opportunity for a study in depth as well as division into sub-periods for comparative analysis.

Choice of Categories. The categories (or major areas of public education) chosen were those that a sample reading of editorials indicated to be the most common and useful in organizing this volume of material: Administration, Curriculum, Finance, the Pupil, and the Teacher. After a careful delineation of the scope of these categories a reliability check was made by an independent reader of one hundred randomly chosen editorials on public education. The same procedure was applied to the "Letters to the Editor."

Organization. All the editorials and "Letters" on public education for these twenty-five years were read, categorized and also classified as favorable, unfavorable or indeterminate.

Statistical Procedures. A sample was taken of one-sixth of all editorials by count and column inch for the years 1926, 1932, 1938, 1944 and 1950. To these data a number of procedures including an analysis of variance were applied.

Summary of Findings

The findings relative to the major questions were

1. The Nature of the Editorial Content. There were over one hundred definable sub-topics in the five major categories. Some educational issues were explored at length while others received brief treatment. The very fact that editors ventured opinions on so many educational subjects would seem to indicate a sense of responsibility to communicate to the people their opinion on these issues. Fifty per cent of the editorials were favorable and twenty-seven per cent unfavorable suggesting that editors took definite stands on many issues.

2. The Volume of Content. The total number of editorials was 2189, each paper averaging 2.86 per month.

3. Reader Reaction. There were nearly twice as many editorials as "Letters" with editors admittedly using their powers of selection in regard to the letters chosen. The rank order correlation between editorial and reader interest in the five major categories indicated an agreement of .60.

The subordinate questions deal with

1. The Chief Interests of Newspapers. Curriculum (including school objectives) and Administration account for sixty per cent of all comment.

2. Curriculum. The main concern of editors lies with the aims and objectives of education in which they attempt to explain certain phases of educational theory to the layman.

Some editorial constants were (1) insistence on fundamentals such as the "3 R's," "discipline," and "democracy"; (2) affirmation of the need for a balance between practical and liberal studies; (3) insistence on the necessity of moral training in the schools.

3. Editorial Leadership. To a great extent this was a product of the special interest of a paper.

4. Trends. Editors have commented on a steady swing from academic to vocational education in this area. Within each sub-period various problems created by a mobile school population are also noted.

5. State-Federal Relations. The key note is the principle of home rule. While federal aid may lead to federal control, it is acceptable for school construction and temporary relief measures.

Microfilm $3.25; Xerox $11.00. 249 pages.

A PROPOSAL TO DEVELOP A COLLECTION OF DOCUMENTS OF AMERICAN HIGHER EDUCATION

(L. C. Card No. Mic 59-3670)

Marceta Joan Seavey, Ed.D.
Stanford University, 1959

The story of the development of American higher education lies inscribed in the enactments of legislatures, in the charters of colleges and universities, in the decisions of courts, in the reports of committees and commissions, in the writing of great educators, and in various other kinds of documents. Were these materials readily available to students of higher education, they might more adequately understand the present scene and thus be better prepared for its problems and those of tomorrow.

Statement of the Problem: The dissertation reports the investigation of three major questions: first, would a general collection of documents in American higher education have utility? second, if such a collection were proved to be desirable, how should it be organized? and third, if developed, what kind of documents should be included?

Procedures of the Study: This dissertation is best termed a pilot study which should assist some later editor or editors in the organization and production of a book of American higher educational documents. Section one reports on the availability of such document collections in other fields and on the dearth of such collections in higher education. Section two reviews the possible organization plans and proposes a source and topic organization for this study. Section three presents 256 sample documents organized by chapters under the following sources and topics: Constitutions, Charters, and Legislation; Judicial Decisions; Correspondence; Inaugural and Other Addresses; Academic Government and Academic Freedom; Finance; and Student Life.

Each chapter in section three presents first a brief historical review of American higher education in relation to the specific source or topic under consideration, and then the sample documents listed chronologically. Each document listing is preceded by a brief annotation of the historical and educational significance of the item and is followed by complete bibliographic information about its most readily available source and by a listing of supplementary readings and discussions. Section four summarizes the study and offers suggestions for later publishers.

Conclusions of the Study: This pilot study prompts the author to make four suggestions to later editors: first, the research for the proposed collection might best be undertaken by a team of workers under the supervision of a senior editor. The team approach would speed up the project and would provide desirable cross fertilization of ideas.

Second, although for this pilot study the author chose to use a topic and source organization, later editors could best use a straight chronological listing of the documents with a complete source and topic index.

Three, although this study presents only a listing of sample items, the projected collection should include complete or long abridgements of the pivotal documents. The research completed for this study verifies the thesis that students of higher education would profit most from reading documents in their original form.

Four, the items selected for a published collection should be limited to those that can be bound in a single volume.

The study provided the writer with an invaluable historical perspective of American higher education. The reading of the dissertation should prove interesting and helpful to students in higher education and in the history of education; however, the final proof of the value of this study will be dependent upon its use by later editors in the production and publication of a volume of documents important in the development of American higher education.

Microfilm $4.30; Xerox $14.40. 334 pages.

EDUCATION, PHYSICAL

A STUDY OF THE SUPPLY OF AND DEMAND FOR CERTIFIED WOMEN TEACHERS OF HEALTH AND/OR PHYSICAL EDUCATION IN THE STATE OF NEW YORK

(L. C. Card No. Mic 59-3643)

Pearl Emma Britton, Ed.D.
The University of Buffalo, 1959

Purpose of the Study. The purpose of this study was (1) to find the number of recent women graduates from colleges within New York State training women to become teachers of Health and/or Physical Education, (2) to ascertain how many of these women remain in teaching in the state, (3) to gather information concerning job opportunities in this field by zone and type of position, (4) to find what the job openings are and may be within a five year period by zone and type of position, and (5) to find why trained women leave the teaching of Health and/or Physical Education in the public schools of the state.

Procedure. Questionnaires were sent to a sample of 445 women graduates from 13 colleges of New York State training women as teachers of Health and/or Physical Education. After 335 (75 per cent) replied to the first letter, two follow-up letters were mailed and a total of 404 (91 per cent) individuals responded. A second questionnaire was sent to 298 school administrators in the state, including all city and village school superintendents and a sample of district school principals. There were 198 replies to the first letter. Two more letters brought the total of replies to 291 (97.6 per cent).

Findings.

1. The information collected from the 13 colleges of the state indicated that there were 206 women graduated in Health and/or Physical Education in 1956; 149 in 1955; 154 in 1954; 168 in 1953; and 190 in 1952.
2. Slightly less than 50 per cent of the women left teaching during the five year period under study and the number of graduates still teaching from any one year of graduation was close to the 50 per cent mark.
3. It would appear from the administrators' questionnaires that the anticipated need for women teachers of Health and/or Physical Education will be greater in the areas of highest population. There will be newly created positions in almost every zone of the state. The need for new teachers seemed to be greater in village schools than in city schools.
4. The greater number of women who have left teaching indicated that they have done so because of home responsibilities. The more children there are in the family, the less apt are the married women to remain in teaching. The second leading cause given by women for leaving the field seemed to be that they had taken positions in other than public schools of this state. Some of the group who had left teaching indicated that they might return at some future date and 59 per cent of this group indicated that they would like to have a refresher course before returning to teaching.

Conclusions. The results of this study seem to indicate that there has not been a steady increase in the number of women teachers being trained. It would appear that many of these women leave the teaching of Health and/or Physical Education in the public schools of the state. There is and would appear to be in the future an ever increasing need for teachers. Unless there is an increase in the number of teachers being trained, there will continue to be a shortage of women teachers of Health and/or Physical Education. It would seem that some action must be taken to attempt to have some of those who leave teaching return to such teaching and that efforts must be made both to retain present teachers and to increase the numbers of women being trained.

Microfilm $2.00; Xerox $5.20. 103 pages.

A MANUAL FOR THE ORGANIZATION, ADMINISTRATION, AND CONDUCT OF SENIOR HIGH SCHOOL PROGRAMS OF PHYSICAL EDUCATION FOR BOYS IN WASHINGTON, D.C.

(L. C. Card No. Mic 59-1937)

Leo Hill, Ed.D.
New York University, 1959

Purpose of the Study

The purpose of the study is to develop a manual for use as a teachers' guide in organizing, administering, and conducting physical education activities in the public senior high schools of Washington, D. C. The manual is constructed to meet the needs of the teacher who is responsible for organizing, administering, and conducting physical education activities along the lines of currently acceptable standards.

Significance of the Study.

Critics have accused the Washington school system of having low standards. The amount of this talk has increased in view of such developments as the integration of schools. There is little foundation for this claim since there has been no recent informative study to offer this evidence. This investigation aims to survey the current practices of the senior high school physical education departments for boys and to determine the strengths and weaknesses of the programs. The manual is offered as a guide for the teachers in order to help them better organize, administer, and conduct the activities offered.

Procedures

The data needed for the study were obtained primarily in two ways. First, current practices in the organization, administration, and conduct of senior high school programs of physical education were obtained from interviews with the chairman of each school physical education department. Second, principles were derived from research studies and the literature -- based on authority. Factors that were considered to affect the school programs in the city were presented and validated by documentation. These data were necessary in order to evaluate the current

practices and to find the strengths and weaknesses of the present programs.

Findings

The investigation indicated that the senior high school departments of physical education have been operating with certain strengths and weaknesses. However, the weak points outnumber the strong points by far.

Recommendations

As a result of the investigation of the school programs of physical education -- for boys -- the following recommendations are made. The recommendations are used as a basis for writing the manual.

Organization of the School Departments

(1) That the School Physical Education Departments develop a written plan of the program of physical education activities.

(2) That the School Physical Education Departments exercise full democratic procedure in the establishment of department rules and policies.

(3) That the School Physical Education Department establish a uniform system of keeping essential records.

(4) That the School Physical Education Departments establish plans and procedures for continuous professional growth of the staff.

(5) That the School Physical Education Departments establish a program of public relations.

(6) That the School Physical Education Departments make maximum use of what facilities are on hand in terms of marking and setting aside courts for special activities.

(7) That the School Physical Education Departments establish ways and means of evaluating the overall program of physical education.

(8) That the School Physical Education Departments expand provisions for the health and safety of the pupils.

(9) That better use be made of the chairmen of the School Physical Education Departments in terms of planning the programs and supervising the staffs.

Administration of the School Departments

(1) That a system be developed to classify the pupils for competition in the activities.

(2) That a system be developed to make for better use of pupil leaders.

(3) That a system be developed for the procurement, storage and repair of equipment and supplies.

(4) That an efficient and time-saving method of taking the roll be developed or adopted.

The Conduct of the Physical Education Activities

(1) That a wide variety of activities be offered with consideration of:

(a) recreational or carry-over sports.
(b) Coeducational activities.

(2) That provision be made for individual or corrective physical education.

(3) That a system be developed for evaluating the status and progress of the pupils in the activities.

Microfilm $4.95; Xerox $16.60. 386 pages.

THE DEVELOPMENT OF AN APTITUDE INVENTORY AND RATING SCALE FOR COMMUNITY RECREATION LEADERS

(L. C. Card No. Mic 59-3802)

Shirley Joice Kammeyer, Ph.D.
State University of Iowa, 1959

Chairman: Assistant Professor Betty van der Smissen

The purpose of this study was to develop an Aptitude Inventory for community recreation leaders. It was essential to the development of this Inventory to construct a Rating Scale for evaluation of the quality of leadership.

The establishment of a criterion of successful recreation leadership was fundamental to the development of these instruments in terms of item content. The Rating Scale was constructed, using a graphic scale of characteristics and an overall rating of 1 to 5 as a general evaluation of leadership ability. The supervisor's overall rating of the leader was used to determine the successful and unsuccessful leader as a basis for item analysis of the Inventory. Face validity was accepted for the Rating Scale and reliability was established by statistical analysis employing the agreement of judges and the rate re-rate techniques. The reliability coefficients for 50 leaders ranged from .617 to .796, while the rate re-rate coefficients for 48 leaders were found to be .886 and .916 for the overall rating and scale score, respectively. Therefore, the Community Recreation Leader's Rating Scale was a valid and reliable instrument for evaluating the quality of leadership for community recreation leaders.

The method of development of the Community Recreation Leader's Aptitude Inventory items was to determine statements relative to recreation leadership based upon the qualities of the criterion and to direct these statements to recreation situations. The Inventory contained 200 items and employed a disagree and agree response.

From a random sample of recreation departments, 98 departments returned the completed Aptitude Inventories and Rating Scales or a total number of 1,331 leaders. The responses were tabulated according to categories of sex, full- or part-time employment, and success rating divided at the median and extremes of the Rating Scale.

The items' discrimination on the Aptitude Inventory between successful and unsuccessful were determined by a fourfold chi square with Yates correction for continuity. Chi square was computed for both the median and extreme divisions of nine categories combined in the following manner: Men part-time, men full-time, women part-time, women full-time, all full-time, all part-time, all women, all men, and the total group.

The more severe test of discrimination, employing the

median separation, resulted in significant items exceeding the number which might be due to chance in all categories except full-time men. Therefore, it was concluded that successful and unsuccessful community recreation leaders, in all categories except full-time men, may be differentiated on the basis of the qualities represented by the significant items.

As evidenced by the frequency of significant items, it can be stated that an Aptitude Inventory for use in screening part-time community recreation leaders can be developed through refinement of the significant items of this study. However, these findings must be considered as exploratory and can be accepted only after subsequent cross-validation.

Whereas most of the items were significant in both the median and extreme divisions of successful and unsuccessful leaders, several items were repeatedly significant in the categories for only the extremes of leadership. The items which demonstrated repeated significance in the extreme division should be retained for the Inventory refinement as useful statements to discriminate between the successful and unsuccessful recreation leaders.

The significant items were grouped by aptitudinal patterns according to the behavioral expressions intended when the items were constructed. On the basis of frequency of expression, the following aptitudinal patterns were important for successful recreation leadership: displaying security and lack of fear in the position of leadership; maintaining a tolerant, flexible atmosphere toward the participants; demonstrating a lack of fear of discipline problems; accepting the respect of participants; a desire to develop leadership among participants; and exhibiting sensitivity and empathy for the problems of participants.

Microfilm $2.30; Xerox $8.00. 173 pages.

AN ANALYSIS OF THE LEADERSHIP FUNCTIONS PERFORMED WITHIN VARIOUS RECREATION AGENCIES AND THEIR EFFECT UPON THE DEVELOPMENT OF RECREATION AS A PROFESSION: A COMPARATIVE AND FACTOR ANALYSIS OF THE JOB COMPONENTS OF SELECTED RECREATION PERSONNEL WITH INFERENCES FOR A PLAN OF CERTIFICATION AND PROFESSIONAL EDUCATION OF RECREATORS

(L. C. Card No. Mic 59-2089)

Hanson Douglas Sessoms, Ph.D.
New York University, 1959

The formative years of a profession are generally characterized by many internal conflicts. Major decisions must be made. Questions concerning programs of education, certification, and professional unity are ever present and must be answered before recognition of the profession is achieved. This has been true of medicine, law, and education. Today, recreation, in traveling the same path towards professionalization, finds that it, too, is confronted by these problems. This study was performed in the hope that its findings may aid in the solving of these and similar conflicts.

The basic problem of investigation was to perform a factor and comparative analysis of the leadership positions of selected recreation agencies in North Carolina in order to determine the interrelationships, similarities, and differences of job titles, duties, and personal qualifications. From these data inferences for the certification and professional preparation of recreation personnel were devised.

A research design utilizing five techniques of investigation and analysis was employed. The major problem was divided into four sub-problems and a sample of forty agencies was selected from a universe of one hundred and twenty agencies. Sub-problems one and two were concerned with the collection of data and the comparative analysis. Sub-problem three was devoted to the factor analysis while sub-problem four dealt with the inferences. Thirty-nine of the forty randomly selected agencies cooperated in the study. Twelve of the agencies were private-voluntary (YMCA, YWCA, BCA); eleven were public; nine, industrial; and seven, institutional.

Concurrent with the selection of the sample, a master list of job duties and personal qualifications was compiled from the literature and check lists developed therefrom. Each full-time recreator employed by the agencies surveyed was asked to complete the check lists thereby indicating the duties they performed and the qualifications they considered necessary for the performance of these duties. The results were tabulated according to position level and agency affiliation. A comparative analysis was then accomplished using graphic and descriptive narration as the means of presentation.

In order to do the factor analysis, eighteen major duties and six major personal qualifications were developed from the master list and submitted to a jury of ten recreators. The jury, following the instruction of the investigator, rated the importance of each qualification to the performance of each duty. Weights were assigned to the ratings; the Spearman-Brown formula was used to establish reliability. Two of Dr. L. L. Thurston's methods of factor analysis were employed and six duty clusters were identified and interpreted.

Upon the completion of the comparative and factor analyses, a set of inferences were submitted to a jury of three for review. The inferences were based upon the data developed in the sub-problems and pertained to plans of classification, programs of professional preparation, and plans of personnel standards and procedures. The universality of the inferences was then discussed.

Briefly, these are the major conclusions and recommendations of the study:

1) The comparative analysis indicated that there are noticable variations in the job titles among the four agency-types for each of the levels of work surveyed and lesser variations within each agency-type at each level.

2) There are a greater number of similarities than differences in the types of duties performed at each level regardless of agency-type and more noticable similarities within each agency at each level.

3) Definite position levels are identifiable when based upon the types of duties performed.

4) A relatively small degree of variation was observed in the ranking of the personal qualifications needed for job performance. This was true both at, and within, each position level.

5) Six factor clusters were identified and designated as interpretive, organizational, developmental, managerial, supervisory, and operational functions.

6) Inasmuch as the study revealed a definite communality of duties performed and personal qualifications needed by the personnel of the four agency-types, it was recommended that agency differences be minimized in view of their alikeness and one professional body representative of all be established.

7) Inasmuch as the factor analysis disclosed six duty functions, each of which appear as a part of every job regardless of position level, it was recommended that the duty functions not be used as the sole basis for classification and that additional qualitative research be done to determine the significance of each function in the performance of a particular job.

8) Inasmuch as the study revealed that a definite core of duties and personal qualifications exist among the various agencies and that each position level contains loading of all six duty functions, it was recommended that programs of professional education of recreators be general in scope. Specialization should occur at the graduate level or on the job.

Microfilm $2.00; Xerox $7.00. 149 pages.

EDUCATION, PSYCHOLOGY

PSYCHOLOGICAL FACTORS ASSOCIATED WITH APPROPRIATENESS AND INAPPROPRIATENESS OF VOCATIONAL CHOICES

(L. C. Card No. Mic 59-3730)

Ensio Emil Aalto, Ph.D.
University of Minnesota, 1959

The study was designed to examine the appropriateness of vocational choices and their relationship to personality maladjustment and to familial characteristics of a "non-clinical" male freshman sample drawn from a two-year college unit within a large university. The primary sample consisted of 177 recent high school graduates, non-veterans, who had been in attendance one year, had a claimed vocational choice, and had taken the required psychological tests. A secondary sample of 59 veterans were studied separately because of a large number of significant differences between the two groups. Samples were representative of the remaining population on the majority of variables under consideration.

Information on parental characteristics were obtained primarily from a 25-item questionnaire that included the Hoppock Job Satisfaction Blank. Four follow-ups resulted in a high percentage of returns.

The appropriateness of the student's first and second choices were judged by three experienced counselors on the basis of a case record containing the Strong Vocational Interest Blank profile (excluding non-occupational keys), high school rank, American Council on Education Psychological Examination, and academic record. The inter-judge reliability was high. Four criterion groups were used in testing hypotheses in the primary sample (inappropriate-inappropriate, inappropriate-appropriate, appropriate-inappropriate, appropriate-appropriate). The limited size of the veteran sample allowed for two groups, those with appropriate and inappropriate first choices.

In the primary sample the null hypothesis of no difference in an adjustment criterion of number of T-scores 70 or above on the Minnesota Multiphasic Personality Inventory between appropriate and inappropriate choice groups was accepted. In the veteran sample the null hypothesis was accepted for the number of peaks above 70 and rejected at the .05 level for the "Pd" and "Mf" scales, with the inappropriate choice group higher.

The null hypothesis was accepted for all criterion groups of both samples on mental ability as measured by the General Aptitude Test Battery "G," age, interest maturity, and masculinity-femininity in the primary sample. Significant differences were found on the Strong MF (.05 level) in the direction of masculinity for appropriate choices in the veteran sample and on the OL (.05 level) for both samples. Higher scores were associated with appropriateness among non-veterans but with inappropriateness among veterans.

On the parental variables null hypotheses were accepted in all criterion groups for level and differences in education of father and mother, father's occupation classified by the Dictionary of Occupational Titles and the Minnesota Scale for Paternal Occupations, jobs held in the past ten years, number of years in present line of work, expressed desire to change if starting over again, and job satisfaction. Non-veterans with appropriate vocational choices chose significantly (.001 level) more fields that were at lower levels than their father and less that were at higher levels.

Detailed descriptive data is given on the student's claimed and measured interests and parental characteristics.

General conclusions. Inappropriate vocational choices for this population may not be associated with personality maladjustment as measured by a clinically oriented instrument such as the MMPI and to most aspects of paternal work experience. The generalizability of findings in other studies of a relationship between emotional disturbance and poor choices is questioned. The relationship found between inappropriateness of choice and tendency to choose an occupation at a higher level than the fathers suggests a hypothesis for further study.

Microfilm $4.70; Xerox $15.80. 368 pages.

THE DIFFERENTIAL PREDICTIVE VALUE OF THE WECHSLER-BELLEVUE SCALE

(L. C. Card No. Mic 59-3662)

Sister Dolores Marie Armstrong, Ed.D.
Stanford University, 1959

The purpose of this study was to determine the validity of the Wechsler-Bellevue Scale in predicting success in nurses' training. Validity was tested by correlating the intelligence test scores with two criterion measures: (a) Licensure Examination, and (b) total Grade Point

Average. The following hypotheses were tested:

(a) Full scale, Verbal and Performance scores will correlate positively with the criteria.

(b) Verbal scale scores will correlate higher with competence in areas of the nursing field calling for conceptual types of abilities.

(c) Performance scores will correlate higher with competence in areas of nursing demanding concrete, performance-type skills.

(d) Because certain subtests may "dilute" the predictive efficiency of the Wechsler for a particular purpose, it may be possible by omitting the negative subtests (those showing the least correlation with the criteria) to find a combination of subtests that will predict the criteria more effectively than the present full scale as used in this study.

PROCEDURE

Subjects. The data used in this study were obtained from the records of three schools of nursing, one degree- and two diploma-granting institutions. All students had completed all courses and were within ninety days of graduation. To insure randomization, selection was made by picking names from a box. Total subjects, two hundred. Forms 1 and 11 of the Wechsler were administered.

Criteria. The State Board Test Pool Examination scores were the chief criterion. The test is composed of six examinations covering the major areas of nursing.

The grade point average included the total credits earned and was calculated on the weights used at the schools of nursing.

Findings. The full scale mean I.Q. of the total nursing group was 120 (verbal I.Q. 121, performance I.Q. 108); this is similar to the general college Wechsler scores reported.

Profile analysis indicates that the verbal subtests are generally higher than the performance subtests. Profile deviations of the subtests from vocabulary level (the standard used by Wechsler in his standardization groups) show that student nurses deviate in the same manner but to a greater degree than either the Wechsler or Estes' (general college) groups.

The Verbal I.Q.s yielded higher r's with the GPA (.65) and SBTP (.70) than the Performance I.Q.s. The r's between performance I.Q.s and the GPA (.38) and SBTP (.44) indicate that this scale measures traits less significantly related to academic achievement in nursing education.

Four performance subtests, Digit Span, Digit Symbol, Picture Completion and Picture Arrangement yielded comparatively low r's....none are significant. The best (high r.) verbal subtest is Arithmetic, the best performance subtest is Block Design; the least best subtest is Digit Symbol.

A multiple regression equation to determine a predicted full scale score on the Wechsler was developed. Using the mean of the nursing school average for the group and the national standard mean on the SBTP of .85 and 500 respectively, a full scale I.Q. of 118 is predicted. Then using the passing score of the schools, .80 and the passing norm of the national boards which is 350, a full scale I.Q. of 109 is predicted.

These findings are of interest particularly because assessment of aptitude in the field of nursing has traditionally been approached through the use of interest, aptitude or vocational tests rather than through the employment of a more basic instrument like the Wechsler Scale.

Microfilm $2.00; Xerox $5.80. 116 pages.

THE RELATIONSHIP OF SELECTED TEST MEASURES TO ADMINISTRATOR SUCCESS IN THE ELEMENTARY SCHOOL

(L. C. Card No. Mic 59-3681)

Alden Wesley Badal, Ph.D.
Stanford University, 1959

With the increasing need for qualified, competent leadership in public education, many school districts are now directing more attention to systematic selection and in-service training programs for potential school administrators. On the assumption that the selection procedures for educational administrators can be improved through research, and further assuming that psychological tests have a place in the selection process, this study is a systematic effort to discover the relationships between test performance scores of elementary school administrators and several criteria of success associated with this role.

Predictor instruments utilized in the study were the Miller Analogies Test, Cooperative Test of Contemporary Affairs, Minnesota Teacher Attitude Inventory, F Scale (Authoritarianism), Allport-Vernon-Lindzey Study of Values, and the Edwards Personal Preference Schedule. Criterion instruments used were the Purdue Rating Scale for Administrators and Executives and the Shipnuk Faculty Morale Rating Scale.

The subjects were 55 elementary school principals who had taken the tests as a part of the regular testing program carried on by the Stanford center of the Cooperative Program in Educational Administration. Four criteria of success in school administration -- superintendent ratings, peer ratings, faculty ratings, and faculty ratings of morale -- were investigated and related. Purdue Rating Scales were administered to the superintendent, fellow principals and the faculty of each subject. Faculty members also completed the morale instrument.

Significance tests comparing principals who took the tests prior to their appointments as administrators and those who took the tests after receiving their appointments revealed that there were no basic test performance differences between the two groups. However, sample principals were significantly higher on the Contemporary Affairs Test and the MTAI, and lower on the EPPS Abasement variable than a group of 596 administrative candidates upon whom test data were available.

A total criterion score for each principal was not justified since the four criteria examined were not all highly correlated. While superintendent and peer ratings correlated .55, the relationships between both of these frames of reference and faculty ratings were quite low (r = .11, .37). However, faculty ratings of the principal and faculty morale ratings were found to have a high positive relationship (r = .79). These findings justified the use of two basic criteria which were designated the "administrative rating criterion" and the "subordinate rating criterion."

The MTAI (r = .28), EPPS Affiliation (r = .37) and EPPS Aggression (r = -.28) combined to yield a multiple correlation of .421 with the administrative rating criterion. For the subordinate rating criterion, AVL Religious (r = .34) and EPPS Abasement (r = .38) combined to yield a multiple correlation of .437. Appropriate best prediction equations are presented for each criterion. Two EPPS variables, Intraception and Succorance, distinguished significantly (.05 level) between the principals who had been promoted since they were rated and those who had not been advanced. The promoted group scored higher on Intraception and lower on Succorance.

Since there were not marked differences between test battery performance of candidates for administrative positions and principals who already held their positions, it appears that the test battery utilized is not highly susceptible to faking. Also it appears that administrators do function somewhat differently on the test battery than does the typical administrative aspirant. The analysis of criterion measures strongly supports the notion that the evaluation of administrative competence differs according to the status or role of the individual in the educational setting. Several relationships between predictor and criterion measures, while being neither dramatic nor conclusive, indicate that the test battery utilized may have a contribution to make in selection procedures.

Microfilm $2.00; Xerox $5.00. 99 pages.

THE RELATION OF ITEM ANALYSIS METHODS TO THE ITEM CHARACTERISTIC CURVE

(L. C. Card No. Mic 59-3733)

Frank B. Baker, Ph.D.
University of Minnesota, 1959

The normal ogive, fitted to the proportions of correct item response occurring at the observed criterion scores was designated as the item characteristic curve. The parameters of the item characteristic curve (item parameters) were defined as follows:

β is the slope of the linear regression line fitted to the normal deviate transformations of the observed proportions of correct response. This parameter expresses the capacity of the item to discriminate.

X_{50} is the criterion score at which the probability of correct response is one-half. This specifies the point on the criterion scale at which the item has its maximum capacity to discriminate.

The empirical investigation was three fold. First, the suitability of the normal ogive as a model for the observed proportions of correct response was investigated. Second, the observed values of the three correlational item discrimination indices (r biserial, the product moment correlation coefficient as estimated by the Flanagan U-L 27% technique, and the Fowler Index of Item Conformity) were computed from the empirical data and compared to the expected values of these indices as calculated from the values of the item parameters X_{50} and β. Third, the sampling properties of the three correlational item discrimination indices and the maximum likelihood estimates (x_{50} and b) of the item parameters (X_{50} and β) were investigated.

A sample of 500 subjects, having a normal distribution of total scores on the first 72 items of the Minnesota Scholastic Aptitude Test (MSAT), was selected. The item difficulty, three correlation item discrimination indices, maximum likelihood estimates of the item parameters, and the X^2 test of goodness of fit of the normal ogive specified by the item parameters to the observed proportions of correct response were calculated for each item of the MSAT. This analysis was performed using programs written by the author for the Univac 1103 "Scientific" high speed digital computer.

The functional dependence of the correlational item discrimination indices upon the item parameter β was shown by the negligible differences between the observed and expected values of r biserial and Flanagan U-L 27% index for the 72 items of the MSAT. The Fowler Index was shown to be a function of the item parameters X_{50} and β.

The normally distributed sample of 500 cases served as the population from which were drawn 25 samples of 10, 25 samples of 30, and 10 samples of 100 cases each. For each random sample the three correlational item discrimination indices and the maximum likelihood estimates of the item parameters were calculated for 15 selected items. The mean, bias, and standard error of the obtained index values were found by sample size for the 15 items.

The conclusions of the study were:

1. When a sample of 500 cases was used, the assumption of the normal ogive as the mathematical model of the item characteristic curve was appropriate for the items of the MSAT.
2. The empirical evidence indicated the use of X_{50} and β for the specification of item characteristics provided a means of unifying the concepts involved in item analysis. When the normal ogive assumption was fulfilled by the empirical data, the values of item difficulty, r biserial, Flanagan U-L 27% index, and the Fowler index were shown to be functions of the item parameters X_{50} and β.
3. A sample size of 100 appears to be a minimum size for obtaining reliable results for either the selected correlational item discrimination indices or the maximum likelihood estimates of the item parameters X_{50} and β. When samples of 100 are used, the sampling properties of the maximum likelihood estimates x_{50} and b of the item parameters X_{50} and β are such that these estimates would be recommended as an item selection technique.

Microfilm $2.60; Xerox $9.00. 199 pages.

THE DEVELOPMENT AND VALIDATION OF AN INSTRUMENT FOR MEASURING ATTITUDES TOWARD SELECTED CONCEPTS IN HIGHER EDUCATION

(L. C. Card No. Mic 59-3734)

Paul Anson Bloland, Ph.D.
University of Minnesota, 1959

Advisers: Dr. C. Gilbert Wrenn and
Dr. Ben Willerman

Considerable interest has developed in recent years in the non-cognitive outcomes of the educational process - the impact of the collegiate experience upon the attitudes and values of college students. The purpose of this study was to develop an objective means of measuring the attitudes of beginning university students toward selected concepts in higher education and to investigate the relationship between this measure and peer judgments of related behavioral characteristics.

Preliminary Forms A and B of the projected attitude instrument were made up of 200 Likert-type statements. Each statement was assigned to one of six scales based upon the six principal educational objectives of the Freshman Camp Program at the University of Minnesota: Intellectual (I Scale); Personal Values (PV Scale); Human Relations (HR Scale); Cultural Appreciation (CA Scale); Vocational Development (VD Scale); and Loyalty (L Scale). The two equivalent preliminary forms were then administered to a sample of entering students and an internal consistency item analysis made of the results for each scale by means of item-test correlation using biserial r.

Preliminary Form C was constructed of new and rewritten items as well as the 91 items which had item-test correlation significant at the .20 level in the first administration. The scale placement of items was verified by a panel of judges. Preliminary Form C then had 118 items divided into five scales with twenty items each and one scale (PV) with eighteen items.

Form C was administered to 183 male and 189 female residence hall students, all freshmen, and another item analysis was made to develop further the internal consistency of the scales. Items which correlated with their respective scale scores at the .10 level of significance were selected to make up the final form of the Survey of Student Opinion and the responses of the two samples rescored on the basis of the final items. The number of items in each scale ranged from 10 to 18 with a total of 87 items in the completed instrument.

Reliabilities, as estimated by the Hoyt-Stunkard analysis of variance technique, ranged from .47 on Scale PV to .78 for Scale CA for males and from .43 on Scale PV to .79 on Scale CA for females. Inter-correlations indicated a fairly high relationship between the I, CA, and HR Scales and with the L Scale to some extent. The PV and VD Scales were relatively independent.

Concurrent validity was estimated by correlating scale scores and scores from a criterion group established by a study of peer nominations. After the scales had been administered, each student was given a nomination instrument with six paragraphs describing the behavioral characteristics of hypothetical individuals who would exemplify the six objectives of the camp program. Each respondent was asked to name the individuals in his or her dormitory house or corridor who were most like and those who were least like the people described in the descriptions. Nomination reliability coefficients ran from .62 to .89, corrected by the Spearman-Brown formula.

For males, only the CA (Cultural Appreciation) Scale correlated wtih the peer nomination criterion significantly at the .01 level (.55). Three scales correlated significantly with the criterion for females: I (Intellectual) at .26, CA (Cultural Appreciation) at .52, and L (Loyalty) at .41. Validity coefficients on the other scales were non-significant.

The use of peer nominations as a validation criterion for measurements probing relatively abstract attitudinal areas is unusual and results appear to justify additional research with this technique, although additional validating criteria should be sought.

Microfilm $2.65; Xerox $9.20. 202 pages.

EFFECTS OF A SUMMER SCHOOL PROGRAM ON RAPID LEARNERS

(L. C. Card No. Mic 59-3663)

Dale Clemens Burklund, Ed.D.
Stanford University, 1959

One of the basic problems in developing educational programs for rapid learners is that research data on the effects of special programs for rapid learners are scarce. There has been even less research on the effects of summer school programs on students of any level of ability. The research findings that are available are inadequate as a basis for judging the appropriateness and potential effectiveness of any proposed special educational program for rapid learners.

This study of the effects of a special summer school program on rapid learners in the fifth, sixth, seventh and eighth grades was undertaken to acquire some research data about this particular type of program. These rapid learners were selected on the basis of IQ, 120 or above on a standardized group test; academic achievement, two years above grade level on a standardized achievement test; teacher observation and recommendation. The summer school rapid learners were matched with non-summer school rapid learners in groups of equal size at each grade level on the basis of group IQ means and standard deviations attained on the California Test of Mental Maturity, Short Form.

The objective of this summer school program was academic enrichment in the usual subject matter areas. Effects assessed were: growth in academic achievement; changes in manifest anxiety; changes in attitudes toward school; changes in health status; and parent opinions about the program. The instruments used for the assessment were the California Achievement Test, Childrens Manifest Anxiety Scale, and three instruments developed for this study - a school attitude scale, health check list and parent questionnaire.

The achievement, anxiety and school attitude instruments were administered in the Spring 1958, prior to the summer school; in the Fall 1958, right after the summer school; in the Spring 1959, six months after the summer school. This testing methodology made possible immediate

and longitudinal assessment of the effects of summer school attendance. This was done by testing the significance of differences in means and mean changes. The health check lists and parent questionnaires were tabulated and summarized in terms of percentages.

The summer school rapid learners made significantly greater growth in reading, arithmetic and total achievement over the summer period and maintained this significant growth differential through the following six months of the regular school year. Summer school rapid learners showed no significant change in anxiety or school attitudes over the period of the study. On the pre-test both the summer school and control rapid learners indicated significantly less anxiety and significantly more positive attitudes toward school than did the average student. There were no significant differences between the summer and control groups in total score means or mean changes in these two areas.

The health status of the summer and control rapid learners was comparable throughout the study. Parents of the summer school rapid learners observed no change in the health of their children during the period of the study. Parental opinions about the program were largely positive. Parents expressed the desire to see the program contined and expanded.

On the basis of these findings it is concluded that a special summer school program for rapid learners does offer a feasible approach for developing the academic potential of able students. A rapid learner summer school might provide the small elementary school district with a method of meeting the needs of its better students, and a means of developing better educational continuity with the comprehensive high school.

Another conclusion is that the effective and efficient development of our human resources might be enhanced by special educational programs and a longer school year for rapid learners.

Microfilm $2.15; Xerox $7.60. 164 pages.

A STUDY OF THE RELATIONSHIP OF THE MEANING OF SELECTED CONCEPTS TO ACHIEVEMENT AND ABILITY

(L. C. Card No. Mic 59-4273)

David R. Cook, Ed.D.
Indiana University, 1959

Chairman: Louis G. Schmidt

In an attempt to find some variables that would be related to achievement in college, independent of mental ability, an exploration was made of the relationship of the meaning of some selected concepts, as measured by the semantic differential, to achievement and scholastic ability.

The main hypothesis investigated was that meaning is related to achievement but is independent of scholastic ability. Stated in terms of the experimentation, a meaning variable has a unique relationship to achievement if it correlates significantly greater than zero with grade-point average and correlates non-significantly with ACE scores.

The technique utilized for measuring the meaning of the concepts, the semantic differential, was developed by Charles E. Osgood and his associates at the University of Illinois. The form of the semantic differential used in this study was administered to 75 men and 119 women, all sophomores, at Indiana University and consisted of 10 concepts and 12 scales as follows: COLLEGE EDUCATION, MY ACADEMIC ABILITY, MYSELF, STUDYING, MYSELF AS A STUDENT, "C" GRADES, THE IDEAL STUDENT, WRITING TERM PAPERS, MY IDEAL SELF, and MY SELF-CONFIDENCE: successful-unsuccessful, weak-strong, active-passive, bad-good, lenient-severe, complex-simple, painful-pleasureable, hard-soft, slow-fast, boring-interesting, mature-youthful, and changeable-stable.

Concept meanings were correlated with grade point averages and the total score of the American Council on Education Psychological Examination (ACE). Some selected distance scores, representing the distance apart in meaning of two concepts, were also correlated with grades and ACE. Some of the meaning variables were combined with the ACE in multiple correlations predicting achievement.

The major conclusions based on the findings from these data were as follows:

1. Differences between men and women in the meaning of some of the concepts showed men giving more "favorable" ratings to the concepts "C" GRADES and MY SELF-CONFIDENCE, and women giving more "favorable" ratings to the concepts STUDYING, WRITING TERM PAPERS, MY ACADEMIC ABILITY, and MYSELF AS A STUDENT.

2. Correlations for the concepts MY ACADEMIC ABILITY, STUDYING, and MYSELF AS A STUDENT were significantly related to achievement but not to ability, an indication that the self rating of ability and a student's concept of himself as a student may reflect fairly accurately the level of achievement which can be expected, beyond that which would be predicted from a measure of scholastic ability. Likewise, the meaning of STUDYING was a reflection of the student's behavior in the study situation, which in turn was reflected in achievement levels, apart from ability. These concepts have some value for predicting achievement.

3. As much as 15 to 20 percent improvement was gained in the prediction of achievement with the ACE total score when certain meaning variables were added to the ACE. This much improvement warrants further investigation of concept meaning as a variable in college achievement.

Microfilm $2.00; Xerox $7.00. 147 pages.

A STUDY OF THE PHENOMENON OF REMOTE ASSOCIATIONS IN VERBAL LEARNING

(L. C. Card No. Mic 59-3791)

Henry Franklin Dizney, Ph.D.
State University of Iowa, 1959

Chairman: Professor James B. Stroud

This investigation was undertaken to study strength of remote associations as a function of two variables: degree of remoteness and serial position of the stimulus term. A transfer paradigm was employed for measuring associative strength.

Two experiments were conducted. In the first, 20 subjects learned serially by anticipation 11 adjectives to a criterion of one perfect trial at each of two sessions. Subsequent to the serial learning, the subject learned five consecutive paired-associate lists, of five pairs each, by the paired-associate anticipation method. Each of these lists contained an experimental pair and a control pair. The experimental pair consisted of two adjectives taken from the previously-learned serial list. The stimulus term of the experimental pair, for each subject, had occupied a constant position within the serial list. The response terms were systematically changed, for each subject and from subject to subject, to correspond to various degrees of remoteness in the serial list. The control pairs consisted of adjectives which had not been previously presented to the subject. Control and experimental material was rotated so that over the entire experiment any given word assumed both functions. Differences in number of trials to anticipate control and experimental material were taken as evidence of the relative strengths of remote associations. Individual learning sessions were utilized and the material was presented at controlled rates on a Hunter Card Master. Ten degrees of remoteness were sampled in the two sessions of the first experiment. Degrees of remoteness were counterbalanced against session and order within session.

Sixty subjects were used in Experiment II. This experiment followed the same general design as the first with a few specific changes. Five degrees of remoteness (0, +1, +3, +5, +6) were sampled at a single session. The criterion for serial learning was the trial upon which six or more of the 11 adjectives were first correctly anticipated. Order of treatments was randomized by subjects. An additional variable, strength of association as a function of serial position of the stimulus word of the remote association, was investigated in this experiment.

No significant differences in associative strength were found among the various degrees of remoteness for either experiment in the transfer paradigm. Latencies of response were determined in the first experiment. These scores also led to acceptance of the null hypothesis for degrees of remoteness. Serial position of the stimulus term was a non-significant source of variation for both the difference score and frequency of anticipatory errors as a measure of associative strength.

Strength of remote associations as determined by the method of anticipatory errors, varied significantly by degree of remoteness. Free-hand smoothed curves indicated that strength of association was inversely related to degree of remoteness up to the third degree and then tended to reverse itself slightly.

Under the conditions of these experiments, it would appear that the concept, remote association, is limited to some extent by the results of this study. However, should the null hypothesis prove to be false in future transfer experiments, the method employed here would have the advantage of providing data from a given subject which is simultaneously specific to a given association and overt in nature. The method would also seem to hold promise for determining more exactly the characteristics of remote associations under various conditions of learning and retention. Microfilm $2.60; Xerox $9.00. 197 pages.

REPORTED EMBARRASSMENT MEMORIES OF ELEMENTARY SCHOOL, HIGH SCHOOL AND COLLEGE STUDENTS

(L. C. Card No. Mic 59-4068)

Esther Horowitz, Ph.D.
Columbia University, 1959

The purpose of this study was to estimate whether embarrassing experiences are less likely to be reported by subjects dissatisfied with their self-concepts than by subjects who express greater self-acceptance. Another aspect of the problem was whether an increase in chronological age is accompanied by a tendency to report fewer early embarrassment memories. Specifically, answers were sought to the following questions:

1. Does the age of reported earliest embarrassment memories increase with an increase in chronological age?
2. Does the frequency of reported early embarrassment memories decrease with an increase in chronological age?
3. Is the proportion of reported embarrassment memories for the period eleven to fifteen years greater than the proportion reported for the period two to eleven years?
4. Is the number of reported embarrassment memories negatively related to the difference between self-concept and ego-ideal?

The subjects were one hundred elementary school students, aged eleven to thirteen years, with a mean age of 11.2 years, one hundred high school students, aged fourteen to eighteen years, with a mean age of 15.6 years, and one hundred college students, aged seventeen to twenty-four years, with a mean age of 20.3 years.

The data were obtained by two questionnaires; first, the Embarrassment Questionnaire, in which each subject indicated whether he remembered having experienced each of 46 presumably embarrassing incidents, the remembered degree of embarrassment and the age at which they for the first time had the remembered embarrassing experience; and second, a Self-Concept and Ego-Ideal questionnaire, in which each subject described the Self as he thought of himself, and the Ideal he would like to be. The sum of the absolute difference between Self-Concept and Ego-Ideal for each of 46 items was treated as the Discrepancy Score.

The results of the study were that:

1. Within each educational group, (elementary, secondary, college) the older the subject the later the reported age of earliest remembered embarrassing experience.
2. Among the three samples a significant difference was found in the frequency of reported early embarrassment memories. The high school and college samples reported fewer embarrassing memories in the period that they were two to eleven years than did the elementary school sample.
3. A greater proportion of embarrassment memories was reported for the period that they were eleven to fifteen years by the high school and college samples than for the period that any sample were two to eleven years. This suggests that the period eleven to fifteen years may be especially vulnerable to embarrassment.
4. On the high school and college levels, the greater the discrepancy between Self-Concept and Ego-Ideal, the fewer the reported embarrassment memories. This may

support the generalization that persons dissatisfied with themselves may avoid reporting embarrassing memories.

The results warrant the conclusion that memory and memory of embarrassing experiences are differentially reported by different chronological age groups. Such reports may be related to the discrepancy between Self-Concept and Ego-Ideal.

Microfilm $2.00; Xerox $5.20. 103 pages.

A PRELIMINARY EXAMINATION OF CERTAIN CORRELATES OF RECRUITERS' RATINGS OF INTERVIEWEES IN AN ON-CAMPUS RECRUITING INTERVIEW

(L. C. Card No. Mic 59-2085)

Dale Braden Lake, Ph.D.
New York University, 1959

Chairman: Professor Milton Schwebel

This study was conducted at Hofstra College and was a preliminary examination of certain correlates of recruiters' ratings of interviewees at the end of on-campus recruiting interviews. Forty-six recruiters and one hundred eighteen interviewees were involved in the study.

A total of ten sub-problems were involved in dealing with the data relative to the six hypotheses on which the study was based. It was first hypothesized that recruiters would rate most favorably those interviewees whose responses on a self-descriptive check list, whose level of co-curricular participation, whose extent of part-time work while in college, and whose general body build most closely resembled the same aspects of the recruiter's own background. It was also hypothesized that recruiters would rate most favorably those interviewees who had a high level of interest in the organization in question prior to and after the interview and those who felt favorably toward the recruiter after the interview. It was further hypothesized that recruiters would react more favorably to high activity levels in part time work and co-curricular participation than they would to a high level of academic achievement in college.

Within the framework of the ten specific sub-problems, data relative to the basic hypotheses of the study were taken from one or more of six instruments. For each sub-problem the data were treated first for 417 interviews as a whole, and then independently for 97 interviews in which the interviewees were applicants for Accounting positions, for 148 interviews in which Administrative positions were involved, for 79 interviews involving Sales candidates, and for 93 interviews dealing with applicants for Scientific positions.

Following each interview recruiters rated interviewees as being in the upper, middle, or lower third of the group interviewed, with the resulting ratings providing data for one variable in each of the sub-problems. Using these ratings and other data from the instruments used in the study, frequencies were determined and appropriate entries made in 3 x 3 contingency tables. A contingency coefficient technique was employed to determine the extent of association between the various sets of variables.

Analysis of data failed to support the hypothesis that recruiters would tend to rate more favorably those interviewees whose backgrounds were most similar to that of the recruiter in any one of the four personal dimensions studied, and likewise there was no support for the hypothesis that the recruiters would rate most favorably those interviewees who, prior to the interview, had evidenced a high level of interest in the organization in question. The remaining four hypotheses did not receive conclusive support, although data relative to each of them revealed significant relationship between certain variables for one or more of the occupational sub-groups or for interviews as a whole.

The level of interviewee's interest in the organization after the interview was statistically significant in its relationship to recruiters' ratings of interviewees when dealing with applicants for Scientific positions, while level of interviewee's feeling toward the recruiter at the termination of the interview yielded significant results for the interviews taken as a whole, but not for Accounting and Sales interviews when occupational groups were dealt with independently. The level of academic performance was significantly related to recruiters' ratings for Accounting and Administrative interviews; level of co-curricular participation was significant for interviews as a whole, but not for Accounting, Sales, or Scientific interviews when dealt with as independent sub-groups; and extent of part time work while in college was significant for interviews as a whole, but only for Accounting interviews when occupational sub-groups were treated independently.

Recommendations for further study include suggestions for replication of the study in other college settings, for investigation of the role played by empathy in the recruitment interview, and for study of the area of change of attitude toward an organization or recruiter during the process of an interview.

Microfilm $2.00; Xerox $7.00. 147 pages.

A COMPARISON OF RESPONSES MADE TO SELECTED PIECES OF LITERATURE BY HIGH SCORERS AND LOW SCORERS ON THE INVENTORY OF BELIEFS

(L. C. Card No. Mic 59-2642)

Margaret Frances Lorimer, Ph.D.
Michigan State University, 1959

This study is concerned with the responses to selected pieces of literature of two groups of college freshmen having widely different patterns of beliefs and attitudes. Twenty-four students who scored above average in aptitude and reading ability, but half of whom scored low and half of whom scored high on an attitude measure, The Inventory of Beliefs, were asked to respond to seventeen literary selections appropriate for use in freshman humanities or English courses. Selections were chosen to evoke values and individual differences in attitudes toward 1) the intellectual as opposed to the practical, intuitive approach to problems, 2) the place of authority and conformity in social control, 3) responsibility of the individual for the welfare of other human beings, and 4) acceptable standards of behavior.

The responses were analyzed 1) to discover differences

in meaning and in implications seen by the two groups, and 2) to find whether the responses of each group clustered around certain attitudes and values which, if identifiable, would have implications for the planning and teaching of literature courses.

The responses in general reflected a tendency among the Low Scorers on the Inventory of Beliefs 1) to prefer the practical vocations to the "intellectual" vocations, 2) to distrust the expert or the theorist who depends on knowledge rather than practical experience, 3) to lean heavily on authority and to identify with or sympathize with authority figures, 4) to find in authority relief from anxiety and escape from decision making, 5) to conform to sanctions of their environment and to be over-conscious of the pressures of society, and 6) to resent criticism of themselves, but to indulge in criticism of others, especially those with different living standards or standards of behavior.

High Scorers tended 1) to put more faith in the expert and theorist and in education and knowledge, 2) to respect those engaged in the "intellectual" vocations, 3) to feel that authority must be based on reason, 4) to make judgments by a hierarchy of values arranged after as careful an analysis as possible of every situation, 5) to welcome opportunities for decision making, 6) to hold little respect for anyone who identifies too easily with the crowd or with any situation which denies independence of thought, and 7) to welcome criticism of themselves by which they might further gain insight into their behavior.

The results showed further that teachers of literature are faced with individual differences quite apart from differences in aptitude and reading ability. Low Scorers appeared to be more likely 1) to misinterpret an author's purpose, 2) to note first in literature such evidence as would confirm their prejudices, 3) to reject such selections as attacked them personally or increased their anxiety, and 4) to miss many of the subtle overtones of literature.

High Scorers appeared to be more likely 1) to examine materials critically and objectively, 2) to project the vicarious experiences of literature into everyday life, 3) to gain from literature some insight and understanding of themselves and the world, and 4) to realize the potential of literature for educating both their minds and their emotions.

A number of signs appeared in the responses to indicate that changes in attitudes are perhaps possible: in a period of seven months, greater changes in attitudes were made by Low Scorers than High Scorers; Low Scorers showed in their responses some consciousness of their prejudices, some insight into the reasons for prejudice, and some awareness of changes taking place within themselves.

The study, besides identifying the tendencies of the two groups in response to literature, gave some encouragement that value-oriented teaching, involving skillfully planned vicarious experiences, group exchange of views about values, and encouragement of independent judgment, might cause students to re-examine their values and consequently alter their attitudes.

Microfilm $2.00; Xerox $6.20. 126 pages.

A STUDY OF EXPERIENTIAL, MOTIVATIONAL, AND PERSONALITY FACTORS RELATED TO VOCATIONAL DECISION VERSUS INDECISION

(L. C. Card No. Mic 59-3755)

James Burke Lyon, Ph.D.
University of Minnesota, 1959

The Problem

This investigation was concerned with psychological correlates of vocational indecision. It sought to determine the distinguishing characteristics of vocationally decided and undecided college freshmen men in the areas of experiential, motivational, and personality factors. A review of the literature on vocational choice theory indicated that there had been little formal research on the problem of vocational indecision and suggested that counselors are handicapped by a dearth of theory and research relevant to the dynamics of vocational indecision.

Hypotheses investigated in this study in the experiential area included differences in familiarity with father's occupation, closeness of identification with father, extensiveness of participation in typical youth activities, and incidence of summer work experience. In the motivational area, hypothesized differences were investigated concerning career and work motivation, perception of valid factors in choosing an occupation, definiteness and masculinity of measured interests, and incidence of scientific-technical versus aesthetic-expressive patterns of interests. In the personality area, it was hypothesized that the measured traits of decided subjects were clinically more normal than those of the undecided, more free of measured evidence of anxiety, and more effective socially and intellectually.

Procedures.

The population studied consisted of freshmen men at Stanford University for the year 1956-57. On the basis of a questionnaire administered on four occasions over a period of 12 months, criterion groups of 82 Decided subjects and 87 Undecided subjects were identified in terms of the consistency of their self-reported vocational plans or lack of plans. Supplementary data were reported attesting to the validity of the subjects' self-reported decision or indecision. For the two groups, it was shown that there were no differences in socio-economic level or in Verbal ability on the CEEB scholastic aptitude test. However, the mathematical factor on the aptitude test was higher for the Decided than for the Undecided group.

Published instruments used in the study included the Strong Vocational Interest Blank and the MMPI plus Welsh's Anxiety Scale and Anxiety Index for the MMPI and four of Gough's non-clinical scales for the MMPI. Several rating scales and checklists were developed and partially validated for measuring experiential factors and career motivation. Research data were collected in the winter quarter of the subjects' freshman year. Statistical procedures included the t-test for difference in the means, the Chi Square test, and a percentage test.

Findings

It was tentatively established that the Decided group was more familiar with father's occupation and more strongly identified with father. There were no differences in activities participation or in number of summer jobs.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The groups did not differ in their ranking of factors in choosing an occupation nor in the definiteness of their interest patterns on the Strong test. There were significant differences in type of measured interest pattern, the scientific-technical pattern favoring the Decided and the aesthetic-expressive pattern the Undecided. The Decided were also significantly more masculine on the Strong test. Differences in work values and in career motivation significantly favored the Decided group. On the personality measures, the findings tentatively favored the Decided group for the Hy, D, and Sc scales of the MMPI and for Gough's Do and Ai scales; the findings significantly favored the Decided on the clinical Pt scale, the anxiety measures, and Gough's Re scale. There were no differences on the Mf scale or on Gough's Ie scale.

It was concluded that the principal correlates of vocational indecision concern the factors of career motivation, work values, and personality dynamics. Limitations in the generalizeability of the findings were emphasized with the recommendation that the study be replicated at a public university. Microfilm $5.05; Xerox $16.80. 394 pages.

THE RELATIONSHIP BETWEEN SELF PERCEPTION AND SCHOOL ADJUSTMENT: A STUDY IN PUPIL ASSESSMENT

(L. C. Card No. Mic 59-3849)

Thomas William Mahan, Jr., Ph.D.
The University of Connecticut, 1959

Purpose of the Study

This study has as its purpose the development of a technique and program of pupil assessment which is a logical outcome of a general theory of human behavior. The entire project is constructed on the basis of a self concept theory of personality and the implications of such a theory for role fulfillment. Specifically, the major hypotheses state:

1. The distribution of ranks based on the discrepancy between self concept and ideal concept of the adjusted pupils will differ significantly from that of the maladjusted pupils.
2. The distribution of ranks based on the discrepancy between self concept and group-ideal concept of the adjusted pupils will differ significantly from that of the maladjusted pupils.

Maladjustment is defined, after a survey of the criteria employed by the teachers whose pupils were subjects for the study, as any of the following:

1. Underachievement - a semester grade average two or more standard deviations below the mean for the individual's IQ group.
2. Overachievement - a semester grade average two or more standard deviations above the mean for the individual's IQ group.
3. Disciplinary difficulty - classification by three or more teachers as a discipline problem.
4. Social isolation - classification by three or more teachers as a social isolate.

Research Procedures and Techniques

All the pupils in the eighth grades of three public schools were chosen as subjects. The total group numbered 240; of these, nineteen were rejected because of lack of data. The final sample consisted of the remaining 221. The basic instrument used was a Q sort and the following were the steps employed.

1. A fifty item Q sort was devised from pupil essays and modified after pilot studies.
2. All subjects were requested to sort the fifty items twice; first, as they saw themselves and then as they would like to be.
3. Pearson "r's" were computed for the relationship between each pupil's self sort and ideal sort.
4. On the basis of definitions above pupils were classed as adjusted or maladjusted.
5. Pearson "r's" were converted into ranks and a non-parametric test of significance made of difference between distributions of adjusted and maladjusted.
6. A modal group ideal sort was derived for each school.
7. A Pearson "r" was computed for each pupil's self sort and his school's group ideal sort.
8. These were ranked and a test of significance made for the difference in distributions.
9. Analyses of variance were made to determine the significance of IQ grouping and school in the results.

Findings

The tests of significance of the differences between the distributions of the adjusted and maladjusted indicated:

1. In each of the three schools and for the three schools combined there was a significant difference between the adjusted and maladjusted groups on the self-ideal ranks.
2. In each of the three schools and for the three schools combined there was a significant difference between the adjusted and maladjusted groups on the self-group ideal ranks.

A further analysis of the data showed that:

1. There was no significant difference among schools on the self-ideal distributions.
2. There was a significant difference among the schools on self-group ideal distributions.
3. In three of six instances there was a significant difference among the IQ groups in the distributions.
4. The modal group ideal sort of School A differed significantly from the other two.
5. There was no significant difference among the four IQ groups in the incidence of maladjustment.

Implications

The theoretical implications of the findings for self concept and role theory are examined, related to classroom practice, and areas demanding further research pointed out. Microfilm $2.00; Xerox $5.80. 118 pages.

TRAIT DIFFERENCES BETWEEN AND WITHIN ETIOLOGICAL CLASSIFICATIONS OF SEVERELY RETARDED CHILDREN

(L. C. Card No. Mic 59-3945)

Roland Alexander Nagle, Ph.D.
University of Michigan, 1959

Data were collected on 54 mentally retarded children in several areas of their development: mental, social, anthropometric and neurological. Their behavior and interpersonal functioning at home and in a day-care school was explored, and measures were derived therefrom. Events and conditions constituting dangers during their prenatal, natal and immediate postnatal periods were also investigated for the purpose of constructing variables from such data. The socio-economic-educational levels of their parents was assessed and quantified for the same purpose.

Each of the 54 children was diagnosed as to the possible etiology of his retardation. This was done under three widely known systems of etiological classification: that proposed by the American Association on Mental Deficiency, by the American Psychiatric Association and by Benda.

The research pertaining to the demonstration of relationships between etiological classifications and the areas of development or functioning listed above was reviewed. Few results were evident which justified wide generalizations. Traditional groupings from a medical orientation were too heterogeneous to enable investigators to obtain consistent and significant results relative to such relationships.

The hypothesis was advanced that, in a study wherein traits, extracted from many life measures of retarded children, were tested for differences in variance between and within etiological categories, the variance in such traits would be as great, proportionately, within these categories as between them. It was further predicted that no significant differences would be found in such traits between children categorized broadly as "damaged" and those wherein no specific neurological damage could be identified. Both predictions were confirmed.

The many classes of information were quantified in ways which allowed the computation of product-moment correlation coefficients. Many relatively detailed measurements were clustered into variables and correlated with each other. Eight preliminary correlational matrices, one for each class of data, were formed by correlating all of the preliminary variables in a given class with each other and with selected representative ones from the other classes. Cluster analyses were carried out on each preliminary matrix to derive multi-item variables (yet as homogeneous as possible) for the final correlational matrix to be factor analyzed. Thirty-two such final variables were constructed out of this preliminary analytical work.

Using the Thurstone Centroid method of factor analysis and a Varimax orthogonal rotational procedure, seven interpretable rotated factors were extracted:

I. General ability.
II. Socio-economic-educational level of parents.
III. Physical growth.
VI. Degree of family interaction.
V. Sociability of child.
VI. Neurological involvement.
VII. Chronological age.

Factor estimate scores were computed for each child for each factor from his respective T scores on the respective definitive variables. One-way analyses of variance were made using etiological categories as the dependent variable and factor estimate scores as the independent variable. None of the F ratios were significant for the estimate scores of any factor except those of factor VI, that of neurological involvement. Here the F ratios, under each of the systems of classification, were all significant beyond the .01 level. A construct validity was demonstrated regarding the meaningfulness of the factors.

Classification of retarded children for etiological purposes should not be used as the basis for predictions of their educational, social, vocational or other achievements. These results, confirming those in recent studies, mean that general areas of functioning by retarded children must be measured and predicted from bases other than etiological classifications, or whether there is or is not neurological damage in general. Such bases for prediction might better be more clearly operationalized overt responses without the interposition of hypothetical constructs of a neurological nature.

Microfilm $2.50; Xerox $8.60. 189 pages.

AN EXPERIMENTAL STUDY OF THE EFFECT OF SOOTHING BACKGROUND MUSIC ON OBSERVED BEHAVIOR INDICATING TENSION OF THIRD GRADE PUPILS

(L. C. Card No. Mic 59-4251)

Charles Hope Patterson, Jr., Ed.D.
University of Virginia, 1959

Purpose. It was the purpose of the study to determine the nature of the effect of background music of a soothing type on the behavior of third grade children in a typical classroom situation. This was attempted through the employment of an experiment designed to (1) measure the effect of soothing background music on observed behavior indicating tension in a typical classroom; (2) study the effect of background music on tension under different types of learning situations; (3) determine the relationship of such effects with the socio-economic position of the pupils; and (4) determine the relationship of the effects with the level of intelligence of the pupils involved.

Method. The time-frequency method of observation was employed. This method involved the observation of individual subjects for the presence of observed behavior indicating tension, as indicated by a sixteen-item category system. Twenty five-minute observations were made on each of sixty third grade subjects over a five-month period by the principal investigator. Observations were made on the same subject at the same time period on alternate days. The time periods systematically varied every two days so that the entire time span of the school day was utilized. Ten observations were made on each subject when soothing background music was played and ten when music was not played. The distributions of the with-music frequency scores and the without-music frequency scores constituted the experimental and control groups respectively for the study. The t-test of the difference of the

means of the control and experimental groups was utilized to test the hypotheses.

Findings.

1. Soothing background music will lessen observed behavior indicating tension of third grade pupils engaged in typical learning situations. The difference between the means of the control and experimental groups was significant at the one per cent level of confidence.
2. Soothing background music had varying effects with respect to the individual category items of observed behavior indicating tension. Ten of the sixteen category items (whispering, nonsense noises, monologue, hums or sings, whistles, quarrels, motor tics, random aimless behavior, random destructive behavior, and non-verbal protests) possessed positively significant differences between their respective means for the control and experimental groups. Six of the category items (talkative, cries, protests, giggles, reverie, and stands in or by seat) did not possess significant differences between their respective means.
3. When the sixteen category items were divided into verbal and non-verbal categories, only the non-verbal category possessed a significant difference between the means of the control and experimental groups.
4. The most significant category item with reference to the reduction of observable behavior indicating tension was that of motor tics.
5. When soothing background music was played the amount of observed behavior indicating tension varied according to the type of learning activity being conducted. Five of the seven classifications of learning activity (written work, small reading group, silent reading, testing, and story hour) possessed significant differences between their respective means of the control and experimental groups at the one per cent level of confidence. Two classifications (class discussion and creative art) did not possess significant differences.
6. Soothing background music had the same effect with respect to the reduction of observed behavior indicating tension on both the low and middle socio-economic groups. Data were not available for subjects of the high socio-economic level.
7. Soothing background music had a positive effect in lessening observed behavior indicating tension in each of the three levels of mental ability in which the subjects were classified.
8. Soothing music employed as a background in the classroom does not have a cumulative effect in lessening observed behavior indicating tension. In order to be effective, soothing background music has to be continuously utilized.

Microfilm $2.00; Xerox $6.40. 134 pages.

AN INVESTIGATION OF THE INFLUENCE OF COUNSELING ON CERTAIN PUPIL BEHAVIOR CHARACTERISTICS AS PERCEIVED BY TEACHERS

(L. C. Card No. Mic 59-4280)

Lon D. Randall, Ed.D.
Indiana University, 1959

Chairman: Louis G. Schmidt

An attempt was made to investigate the influence of group counseling on certain pupil behavior characteristics as they were perceived by teachers. These aspects of pupil behavior included the areas of social skills, study habits and skills, personal goals, personal conduct, attitudes toward school, and emotional adjustment. More specifically, an attempt was made to determine the change in: (1) certain pupil behavior characteristics as they were perceived by teachers and (2) in pupils' attitudes toward their teachers, both of which came about as a result of a period of intensive group counseling. In addition, the relationship of pupil behavior to teacher-pupil rapport was investigated.

It was not intended that the teacher-pupil relationship be considered in terms of its complex psychological dynamics. Rather, emphasis was placed upon some of its more obvious aspects such as the pupil behavior characteristics previously mentioned, and how teachers perceived those characteristics to be related to teacher-pupil rapport.

Two hypotheses were investigated:

1. A period of intensive group counseling will improve pupil behavior characteristics as perceived by teachers.
2. A pupil's attitude toward his teachers will be improved through intensive group counseling.

Students included in the study were referred by their teachers for counseling in one of two groups: (1) those with whom they felt they had excellent rapport and (2) those with whom they felt they had a lesser degree of rapport. Students in group one did not receive counseling but were chosen to determine the significance of pupil behavior to teacher-pupil rapport. Students in group two were divided into experimental and control groups for counseling purposes. In an attempt to determine the influence of group counseling upon pupil behavior and attitudes, comparisons were made of pre-counseling and post-counseling rating scale records of an experimental group, which received counseling, and a control group, which did not. The significance of pupil behavior to teacher-pupil rapport was determined by comparing the behavior and attitude ratings of the students in group one with those of the students in group two. A "t" test of significance was used to determine the statistical significance of any differences that might have occurred.

Based on the findings of the investigation the following conclusions were presented:

1. There are significant differences between students who have excellent rapport with their teachers and those who have a lesser degree of rapport with their teachers in terms of age, sex, grade level and Otis I.Q. scores.
2. Students who have participated in group counseling exhibit a positive change in their behavior, as perceived by teachers, while those who are not counseled are perceived by teachers to remain constant or tend to exhibit negative behavior changes.
3. As measured by behavior rating scales, teachers

perceive significant positive behavior changes in students who have been counseled as compared with those who have not in the areas of social skills, personal goals, emotional adjustment, school attitudes and personal conduct.

4. While group counseling does not appear to effect a positive change in a pupil's attitude toward his teachers, it does tend to hold opinions constant, while those students who are not counseled exhibit significant negative changes in their opinions of their teachers.

5. Students with whom teachers feel they have excellent rapport receive significantly higher behavior ratings and also have a higher opinion of their teachers than those with whom teachers feel they have a lesser degree of rapport.

6. According to the measured perceptions of teachers, the areas of personal goals, emotional adjustment, school attitudes, study skills and personal conduct are significant in terms of teacher-pupil rapport.

Microfilm $2.00; Xerox $6.60. 137 pages.

A STUDY OF THE ACCEPTABILITY OF SPECIFIED STUDENT BEHAVIOR TO STUDENTS, FACULTY, AND STUDENT PERSONNEL STAFF

(L. C. Card No. Mic 59-4283)

Thomas Calvin Schreck, Ed.D.
Indiana University, 1959

Chairman: Kate H. Mueller

In dealing with the disciplinary offender on the campus, the personnel administrator needs to know something of the standards of conduct endorsed by the various components of the campus community. It is important to ascertain what standards are supported by various campus sub-groups, such as personnel administrators, faculty, and students, and to understand any disagreement found in the standards of each group.

It was the purpose of this research to assess the standards of student conduct supported by various components of the university community including students, faculty, and student personnel staff. If differences were found to exist between standards supported by the compared groups, an attempt was made to investigate the extent, direction, and significance of these differences.

The problem under investigation was stated in question form. To what extent do the behavior standards as expressed by students, faculty, and student personnel staff differ? To what extent do certain sub-groups of students exhibit different standards? If differences do exist, what are their direction and extent for each group in relation to the remaining groups? What are the relative standards supported by each of the compared groups?

A 100-item Opinion Scale on Student Behavior was developed by the investigator to include representative student offenses classified as follows: general conduct, automobile and traffic, mischief, sex offenses, drinking, cheating, and theft. Each offense was rated on a seven-point rating scale with ratings varying from "generally acceptable" to "vicious, a serious crime."

The instrument was administered to five groups selected to represent various components of the campus community. These groups included: (1) fraternity and sorority presidents, who, as students, are responsible for the conduct of their particular living unit; (2) students who display high moral and social standards as determined by professional personnel staff, referred to as a high social integration group; (3) students who tend to lack social responsibility as determined by professional personnel staff, referred to as a socially non-integrated group; (4) faculty; and (5) student personnel staff.

To measure the existence of a difference between groups, the analysis of variance statistical model was utilized. In order to determine the relative effect of each group on the differences found, additional analyses of variance were computed omitting one group, each in turn, from the study. By observation of the mean ratings of groups by category, the directions of the observed differences were determined. The means were also used to determine the relative standards supported by each of the compared groups.

Based on the findings of this study the following conclusions were presented:

1. A significant difference exists between compared groups in over-all standards of conduct.

2. A significant difference exists between compared groups in standards of conduct related to all seven specific categories of conduct.

3. The faculty group tends to display a higher standard of conduct for students than the remaining compared groups.

4. The fraternity and sorority presidents group presented the lowest standards of conduct for students of the compared groups.

5. The student personnel staff displayed a standard of conduct more compatable with standards reflected by student groups, rather than the standards reflected by the faculty group.

6. The high social integration student group and the socially non-integrated student group, judged to represent extremes on a conduct continuum, did not reflect standards of conduct which were the extreme, when compared to all groups.

Microfilm $2.30; Xerox $8.00. 173 pages.

THE CONSTRUCTION OF A FORCED-CHOICE RATING SCALE FOR COLLEGE INSTRUCTION

(L. C. Card No. Mic 59-4285)

John Haggner Snedeker, Ed.D.
Indiana University, 1959

Chairman: Raymond C. Gibson

This study was initiated to satisfy an observed need in the field of teacher evaluation for an instrument of measurement less prone to the inhibiting factors of rater leniency, rater bias, and halo effect, which have plagued conventional rating methods. The purpose of this study was to construct a forced-choice rating scale for college instructors. This scale would serve to measure student opinion of college instructors as teachers.

A questionnaire was developed and administered to 471 senior college students for the purpose of collecting favorable and unfavorable items, descriptive of college teacher behavior.

A careful editing and first phase pre-validation against established criteria reduced the item pool to 164 descriptive behavioral items. This phase of pre-validation involved a group of 50 faculty members, comprised of scientists, professional educators, and psychologists.

During the second phase of pre-validation, a total of 375 judges were employed. These judges were composed of 300 students and 75 faculty members from various schools and divisions of the university. The judges rated the items in three separate ratings on a one-to-five continuum. Analysis of these ratings provided preference indices and discrimination indices for the descriptive behavioral items. These procedures eliminated 116 items.

The remaining 48 descriptive behavioral items were arranged in tetrads to form the forced-choice scale. Each tetrad contained four favorable items; two discriminating items, and two non-discriminating.

Cross-validation of the scale was achieved through application of same in a different college environment. The scale was administered to a random selection of 112 college instructors in a large Mid-Western Teachers College and yielded 7,974 ratings. A re-test situation using an equivalent parallel form of the scale was created three weeks later using the same instructor sample. This plan yielded 8,040 ratings.

Conclusions

The following conclusions based upon the findings of the study are warranted:

1. The internal consistency reliability of Form A of the scale determined by the Horst formula is .96.
2. The internal consistency reliability of Form B of the scale using the Horst formula is .96.
3. The reliability of the scale computed using the Pearson product-moment correlation technique is .95.
4. Students are aware of and can describe differences in teaching behavior in favorable terms. Although such differences are described in favorable terms, they do discriminate at a statistically significant level between effective, and ineffective college instructors.
5. Student opinion of college instruction is reliable and stable. Microfilm $2.00; Xerox $5.60. 114 pages.

TEACHER ROLE EXPECTATIONS AND THE INTERNAL ORGANIZATION OF THE SECONDARY SCHOOL

(L. C. Card No. Mic 59-3672)

Stanley Soles, Ed.D.
Stanford University, 1959

The problem of the study was to find out if teacher role expectations were significantly related to the type of internal organization, viz. curriculum scheduling, used in the school. A claim had been made numerous times during the past decade that teachers in the multiple period curriculum scheduled schools would tend to find counseling and guidance a natural and integral part of the teaching role. To test the claim and clarify issues, hypotheses were formulated and were tested by assessing teacher role expectations with a cross-sectional research design.

Eight junior high schools, four with single period curriculum scheduling and four with multiple period curriculum scheduling, were matched according to three characteristics of their student populations: (1) percentage of college preparatory; (2) percentage of various ethnic groups, (3) distribution of parents' occupations. Schools were located by means of a questionnaire and interview with school principals.

Three hundred teachers responded to the Valenti-Nelson "Survey of Teaching Practices" (Science Research Associates), an instrument designed to measure the social role of the teacher. The four roles in the instrument were described as follows: Role A: Impersonal, bureaucratic approach to teaching; Role B: Self-sufficient, technical expert emphasis, authority unquestioned; Role C: Counseling and guiding of the individual personality of pupils; Role D: Group development, or group process emphasis. The reliability of the instrument was reported to be +.79, +.74, +.65, and +.87 for Roles A, B. C, and D respectively. The Validity for all roles combined, using supervisor and principal's ratings as an external criterion, was indicated by an r = , +.59.

Hypotheses and Findings

Hypothesis One: Teachers from the multiple-period curriculum scheduling schools will tend to prefer higher "Counseling and guidance" role expectations than teachers from the single-period curriculum scheduling schools. (Higher Role C and Role D scores were predicted for the staff of teachers from the multiple period schools.) Findings: For 3 of 4 pairs of schools no significant differences were found between mean staff Role C scores, i.e. counseling and guidance role expectations. But teachers from the multiple period schools did have significantly greater preference for the group development role expectations, as indicated by higher Role D scores.

Hypothesis Two: Teachers from the single period curriculum scheduling schools will place greater emphasis than teachers from the multiple period schools upon a "subject transmitter" approach, indicating a preference for an impersonal and self-sufficient set of role expectations. (Role A and Role B respectively). Findings: For 3 of 4 pairs of schools no significant differences were found for the impersonal, bureaucratic role expectations (Role A), but single-period school teachers did emphasize a self-sufficient set of role expectations significantly more than teachers from the multiple period type school, as indicated by higher mean Role B scores for the staff from single period schools.

Hypothesis Three: There are no significant differences in role expectations for teachers who differ on personal and situational characteristics. Teachers were combined and regrouped regardless of school type for hypothesis three. Findings: One-way analysis of variance indicated that role scores did vary according to teaching assignment. By means of correlation, it was revealed that older teachers in this study got significantly higher Role D scores than younger teachers. The fewer the number of college courses taken since graduation by teachers the higher was the Role B score (teacher authority emphasis). Those teachers who had at least a Master's degree got significantly higher Role D scores, while those teachers with a Bachelor's degree or less got significantly higher Role B scores. By comparing mean role scores, male teachers

were found to have significantly higher Role A scores than female teachers, but female teachers got significantly higher Role D scores than males.

For a small sample of teachers, matched in age and sex, role scores were compared for the two types of schools in order to study organizational effects with personal variables held constant. Female teachers regardless of age or type of school organization did not significantly differ in role scores. The younger male teachers from the two types of school organizations had significantly different role scores. Younger male teachers from the single period schools emphasized Role B with high scores, while younger male teachers from the multiple period schools got significantly higher Role C and Role D scores.

Recommendations were made for research into the development of role expectations over a period of time. It was suggested that role expectations, role behavior, and type of organization be studied in relation to subsequent changes in pupil behavior.

Microfilm $2.80; Xerox $9.60. 213 pages.

COSTS OF GUIDANCE SERVICES IN SECONDARY SCHOOLS IN A COUNTY SYSTEM

(L. C. Card No. Mic 59-3674)

Robert Erland Stockhouse, Ed.D.
Stanford University, 1959

The purpose of this study was to discover and analyze the costs of guidance services in the public secondary schools of Santa Clara County, California. Twenty-nine schools in ten school districts were studied. Data were obtained by questionnaires and by interviewing administrative and guidance personnel at each school, and at district and county offices.

Costs of guidance services for each district were determined in categories as follows. Guidance salary included salary of guidance director, counselors, and clerical staff, prorated for time spent in organized guidance functions. Testing included cost of tests, administration, and scoring. Vocational information included cost of vocational information. Records included forms used in the guidance program. Psychological services included services of psychologists.

Costs were calculated for each district on the basis of cost per pupil in average daily attendance (ADA) and cost per pupil enrolled in October and March. Total guidance program costs were compared with total cost of education. Approximate counseling time available per pupil in ADA was also computed.

A brief comprehensive description of the organized guidance services is given for each school together with charts illustrating the administrative organization.

Conclusions of the Study

Eight districts operating four-year high schools with a total ADA of 15,397 pupils, spent an average of $16.68 per pupil in ADA for the total guidance program. When itemized by category this amounted to $15.58 per pupil for guidance salaries, $0.73 for testing, $0.14 for vocational information, $0.07 for records, and $0.13 for psychological services. Range of costs per pupil for the total guidance program was from $10.43 to $19.84. The approximate counseling time per pupil in ADA was 2 hours 04 minutes. Guidance programs represented 3.5% of the total cost of education for these districts.

Two districts operated junior high schools with a total ADA of 7,053. The average cost per pupil in ADA for the total guidance program at the junior high level was $19.49. When itemized by category this amounted to $17.68 per pupil for guidance salaries, $0.99 for testing, $0.06 for vocational information, $0.07 for records, and $0.70 for psychological services. The approximate counseling time per pupil in ADA for the junior high schools was 2 hours 17 minutes. Guidance programs represented 3.9% of the total cost of education for these districts at the junior high level.

Two districts operated senior high schools with a total ADA of 5,393. Average cost per pupil in ADA for the total guidance program at the senior high level was $25.82. Itemized by category this amounted to $23.84 per pupil for guidance salaries, $1.11 for testing, $0.28 for vocational information, $0.14 for records and $0.45 for psychological services. The approximate counseling time per pupil in ADA for the senior high schools was 2 hours 53 minutes. Guidance programs represented 4.3% of the total cost of education for these two districts at the senior high level.

Total ADA for all public secondary schools was 27,843. Average cost per pupil in ADA for all schools in the county was $19.16. Itemized by category this amounted to average costs of $17.71 per pupil for guidance salary, $0.87 for testing, $0.15 for vocational information, $0.08 for records and $0.33 for psychological services. The approximate counseling time per pupil in ADA for the county was 2 hours 17 minutes. Guidance programs represented 3.8% of the total cost of education for all secondary schools in the study.

Recommendations for further study are presented and discussed. Microfilm $2.00; Xerox $7.00. 150 pages.

DEVELOPMENT OF AN ORGANISMIC MATURITY-ADJUSTMENT SCALE FOR FOURTH, FIFTH, AND SIXTH GRADE ELEMENTARY SCHOOL CHILDREN

(L. C. Card No. Mic 59-2093)

Alvin Trachtman, Ph.D.
New York University, 1959

The major purpose of this investigation was to develop a method for assessing the organismic developmental status of fourth, fifth, and sixth grade children. A scale was to be developed based upon a weighted combination of physical growth, physical performance, mental status, and social-emotional adjustment measures. Sex and grade differences in developmental characteristics as well as in the interrelationships among the developmental characteristics were to be determined. The potential value of the study was that it would increase the available knowledge concerning the "total" child and the interrelationships involved in several major aspects of his development.

The subjects consisted of at least fifty boys and fifty girls at each of the three grade levels indicated, attending the Herricks Public Schools in suburban Nassau County,

near New York City. All measurements were obtained within the period of a single school year. Physical growth measurements included height and weight. The physical performance measurements were vertical jump, modified push-ups, and agility run. Mental status was based on total mental age on the California Test of Mental Maturity and also upon total reading and total arithmetic scores on the Metropolitan Achievement Test. Social-emotional adjustment was based upon personal adjustment and social adjustment scores on the California Test of Personality, and also upon teacher's ratings of children on the combined social and emotional items of the Haggerty-Olson-Wickman Scale.

The treatment of the data involved determination of significant differences between means and standard deviations for boys and girls, and among the three grade levels. Intercorrelations among developmental characteristics and also of each characteristic with the criterion score were obtained. The criterion used was a multiple battery criterion based upon the sum of the standard scores for each developmental characteristic. The Wherry-Doolittle Test Selection Method was applied to determine appropriate weighting for each characteristic. This was done separately for each of the six grade-sex groups. The significance of differences between boys and girls and among grade levels was determined in regard to interrelationships.

The results of this investigation revealed lack of significant relationships among developmental characteristics in four pairs out of six. A low positive correlation was found between mental and social-emotional characteristics, for all three boys groups and for fourth grade girls. A low negative correlation was found between physical growth and physical performance for all three boys groups and for sixth grade girls. The correlations of developmental characteristics with criterion scores were all found to be significantly positive. Multiple correlations using the best three out of four characteristics were above .88 for each grade-sex group.

While significant differences were found between boys and girls and among grade levels in regard to all developmental characteristics, no significant differences occurred in regard to the interrelationships among the developmental characteristics. These findings indicated the need for using appropriate grade-sex norms for determining the standard scores of an individual child on each measure. They also indicated that the standard scores for each developmental characteristic should be equally weighted in order to obtain the organismic score.

The organismic scale which was developed in the course of this research was found to have properties suggesting its potential value for future developmental research and also for practical group assessment purposes. This was demonstrated through the presentation of case study material and also through comparisons of extreme groups on the organismic scale and on each of the specific sub-scales. The organismic scale proved to be most effective for differentiating children referred for psychological evaluation, and second only to the mental scale for differentiating class marks.

Microfilm $2.85; Xerox $9.80. 217 pages.

THE INFLUENCE OF AN ORIENTATION PROGRAM ON ATTITUDES TOWARD HIGHER EDUCATION

(L. C. Card No. Mic 59-3774)

Donald Richard Zander, Ph.D.
University of Minnesota, 1959

Advisers: Dr. C. Gilbert Wrenn and
Dr. Ben Willerman

Purpose: The purpose of this study was to determine the influence of an informal, short-term orientation program on the attitudes of new students toward the objectives of higher education.

Sample and procedures: The Freshman Camp program at the University of Minnesota was the orientation program studied. The instrument used in this study was Bloland's (1) attitude survey concerning six basic purposes of higher education. This instrument was developed to measure the students' understanding of their expectation of growth in these areas - intellectual activity (I), personal values (PV), human relationships (HR), cultural appreciations (CA), vocational development (VD), and college loyalty (L). Each area was represented by a scale. The attitude survey was administered to all new students during the Two-Day Orientation-Registration program in August and September, 1957. All students who volunteered for the camp experience were assigned to one of six camps, assignment being made by the use of a table of random numbers.

The students who participated in the camp experience were divided into control (N = 106) and experimental (N = 287) groups. The control group repeated the attitude survey just before the camp actually commenced and the experimental group repeated it immediately after the camp experience. Further division of these groups were made on the basis of sex and attendance at one of the six simultaneously held camps.

Students and faculty most closely associated with the planning and implementation of the various camp programs were asked to judge the effectiveness of programs related to the aforementioned areas.

The t-test was used to evaluate the statistical significance of the results.

Analysis: There were significant differences between the total experimental and total control groups on each of the six scales and between the experimental and control females. The changes were in the direction of better understanding of the objectives of higher education and were at the .001 level of confidence. The males were significantly different at the .05 level on the cultural appreciation, vocational development, and loyalty scales. On the other three scales males made changes in the desired direction, but the changes were not significant. The small control group and negative changes within this group limits any generalization of the results.

Correlation coefficients indicated a fairly high interrelationship between the I, CA, and HR scales and to a less extent the VD scale. The PV and L scales were quite independent. A relationship was expected between some of the scales because of the manner in which the objectives of higher education are interrelated.

Programs ranked high on effectiveness by camp staff seldom had significant changes on the related attitude scale.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Females made higher raw mean scores than males on every scale except the PV scale. In the control group females scored lower, but not significantly so, than their initial score on each scale.

Implications: Few orientation programs have been planned to influence the attitudes of new students toward the objectives of higher education. Evaluational research has rarely been attempted on a program with this purpose. The results of this study indicate that the objective of modifying attitudes toward higher education may be realized in a short, informal orientation program.

REFERENCES

1. Bloland, P. A., The Development and Validation of an Instrument for Measuring Attitudes Toward Selected Concepts of Higher Education, Unpublished Doctor of Philosophy Thesis, University of Minnesota (1959).
Microfilm $2.40; Xerox $8.40. 182 pages.

EDUCATION, TEACHER TRAINING

A STUDY OF IN-SERVICE TEACHER EDUCATION PROGRAMS AT CERTAIN TEACHER TRAINING SCHOOLS IN EGYPT

(L. C. Card No. Mic 59-4266)

Fikry Hassan Ali, Ed.D.
Indiana University, 1959

Chairman: Raymond C. Gibson

The Problem: The purpose of this study was to determine the status of in-service teacher education at the general teacher training schools in Cairo, Egypt in terms of utilization of selected criterion measures. Specific purposes of the study were to determine:

1. The validated kinds of in-service education activities and opportunities that are offered to teachers.
2. The extent to which valuable techniques and procedures are used in carrying out these activities.
3. The extent to which techniques and methods of questionable value are used in carrying out these activities.
4. The extent of teachers participation in these activities.
5. The role of teachers participating in these activities.
6. External incentives used to encourage teachers to participate in these activities.
7. Teachers' attitude toward engaging in these activities.
8. Accomplishment and failures of in-service education programs.

The Procedure: Data for this study were secured through questionnaires. For this purpose a check list was constructed, based on certain criteria universally accepted. The jury responding to the check list was composed of 20 professors of education at certain American universities and 20 teachers experienced in in-service education. A technique or a practice that was checked by 80 per cent or more of the jury on the highest two points of the four-point scale used, was accepted by the investigator as a valuable technique or practice in good in-service education programs. On the basis of the check list a questionnaire was constructed and distributed among teachers at the 13 general teacher traing schools in Cairo and its surrounding area. The number of questionnaires distributed was 392. The questionnaires returned and usable were 355, which represented 90.6 per cent of the copies sent out.

Conclusions: On the basis of the findings of this study, the following conclusions are made:

1. Valuable in-service education activities and opportunities are offered.
2. Activities of little or no value are also practiced.
3. Frequency of using valuable techniques is only partially satisfactory.
4. The extent of teacher participation in each of the practiced activities is satisfactory only to a limited extent.
5. The extent of teacher participation in various activities, the frequency of using valuable techniques, offering certain opportunities for in-service growth, and incentives used to encourage participation are not used or stressed in accordance with the relative value of each of these activities, techniques, opportunities, or incentives.
6. Various valuable phases of school libraries are adequate only to a limited extent.
7. A majority of teachers felt that the school had the right to require them (1) to grow professionally, and (2) to attend in-service activities on school expense and teacher's time.
8. The extent of the effectiveness of in-service education programs in realizing validated valuable objective is satisfactory only to a limited degree.

Recommendations: In light of the findings of this study, the following recommendations are made for the improvement of in-service education programs at the general teacher training schools in Egypt.

1. In-service programs should be continuously evaluated.
2. Reorganization of programs should be made in order that they become more effective in realizing the validated objectives.
3. Frequency of using the valuable techniques and procedures in carrying out the in-service activities should be increased.
4. The emphasis put on various activities and techniques of in-service education should be planned and carried out in accordance with the relative value of each of them as indicated by the jury.
5. Paid expenses for participation in activities, and release from school duties to attend them should be emphasized as external incentives.
6. Cooperative evaluation of teaching by the teacher, the supervisor and/or the principal should be emphasized.
7. Various phases of school libraries: professional materials, material in subject areas, organization of materials, library furniture and building, should be improved.

Microfilm $2.40; Xerox $8.40. 183 pages.

AN ANALYSIS OF ADMINISTRATIVE POLICIES AND PRACTICES RELATED TO OFF-CAMPUS STUDENT TEACHING IN MISSOURI

(L. C. Card No. Mic 59-4271)

Alexander Michael Chabe, Ed.D.
Indiana University, 1959

Chairman: Hanne J. Hicks

Problem

To develop professional criteria to guide administrative practice in selected aspects of the off-campus program of elementary student teaching and to determine and appraise current administrative practice in those selected aspects at Park College and in teacher education institutions in Missouri.

Procedure

From the literature and research studies, 20 principles were formulated and supported by documentation. A ballot form of the principles was presented to 15 selected jurors. Seventeen principles were justified by 13 jurors and constituted a set of professional criteria. A questionnaire, based on these refined professional criteria, was prepared for a pilot study conducted in 10 midwestern states. Following the pilot study, data for the regular study were obtained by means of a questionnaire sent to 23 Missouri institutions offering a four or more year program for the preparation of elementary school teachers. The results of the study were based on questionnaire responses from 20, or 100 per cent, of the Missouri institutions which conducted an off-campus program of elementary student teaching. To confirm the reliability of the questionnaire data, interviews were conducted with the director of elementary student teaching in five selected Missouri institutions. Using five levels of implementation, the administrative practice at Park College and in the Missouri institutions was appraised.

Conclusions and Implications

From an analysis of the data, the following major conclusions and implications were drawn: (1) the formulation of written objectives, the development of plans or policies, and the evaluation of the student teaching program were generally not a cooperative endeavor involving teacher education institution personnel, cooperating school system personnel, and student teachers; (2) the institutions should explore the possibility of drawing up, for an agreed upon period, a comprehensive written contractual agreement or a memorandum with the cooperating school system; (3) the institutions needed to pay increased attention to the values of a program of in-service training of cooperating school system personnel which also provided various types of in-service training activities; (4) generally, follow-up programs were not very extensive; and (5) many of the 17 professional criteria needed fuller implementation at Park College and in the 19 Missouri teacher education institutions.

Recommendations

Out of this study, the following recommendations are made: (1) a council on student teaching should be organized and should include, in its membership, the student teaching staff, cooperating teachers, administrators and/or supervisors of the cooperating school system, other members of the education faculty, members of the academic faculty, and student teachers; (2) supervisory visits to an elementary student teacher should be as frequent as possible consistent with other considerations relative to the student teaching program; (3) granting expense money to cooperating teachers for regional and state conferences on student teaching and paying professional membership dues to the Association for Student Teaching should be considered by the institutions; (4) institutions should seek to obtain sufficient institutional budgetary support for the student teaching program; (5) institutions, in cooperation with officials of the cooperating school system, should regularly conduct workshops and organize study groups concerned with the student teaching program, its procedures and problems; (6) institutions should develop an organized and comprehensive program of follow-up continuing from one to two years after the graduation of the former elementary student teacher; and (7) through visitation, if possible, to the employing school, the institution should provide on-the-job assistance to the graduate.

Microfilm $4.70; Xerox $15.80. 367 pages.

A COMPARATIVE ANALYSIS OF THE EXPRESSED ATTITUDES OF ELEMENTARY EDUCATION STUDENTS, THEIR UNIVERSITY INSTRUCTORS, AND THEIR SUPERVISING TEACHERS TOWARD PUPIL-TEACHER RELATIONS AS MEASURED BY THE MINNESOTA TEACHER ATTITUDE INVENTORY

(L. C. Card No. Mic 59-4274)

Arthur Fulton Coss, Ed.D.
Indiana University, 1959

Chairman: Hanne J. Hicks

The purposes of this study were: (1) To determine whether significant changes in the attitudes of representative elementary education students toward pupil-teacher relations occur during the various phases of the professional sequence; (2) To determine whether change in the attitudes of trainees gravitated toward the attitudinal level of their methods instructors and their supervising teachers.

The Minnesota Teacher Attitude Inventory (MTAI) was administered to two groups of elementary education majors at Indiana University during the two-semester sequence of professional training and experience. During the period from February 11, 1955, to May 24, 1956, measurements were obtained from the 43 students constituting Group I and the 80 students constituting Group II at the beginning and end of the workshop; an additional measure was obtained from Group I at the end of summer vacation.

Single scores on the inventory were obtained from the 11 methods instructors and 151 supervising teachers.

Fisher's "t" test was applied to all possible pairing of administrations of the MTAI to both groups of subjects to determine whether significant changes occurred.

In the second portion of the study the investigator attempted to determine whether or not the final attitudinal level of a student was related to the attitudinal level of his supervising teacher. For this analysis all students

who had been supervised by only one supervising teacher were aggregated from Groups I and II. The 73 subjects resulting from this selection were grouped in "High," "Medium," and "Low" groups on the basis of the MTAI scores of their supervising teachers. The analysis of covariance was applied to all consecutive points of measurement in order to disassociate any initial differences.

Conclusions

The major conclusions were as follows: (1) The attitudinal levels of elementary education students toward pupil-teacher relations were flexible and fluctuating since directional changes were evidenced during periods of methodology training, summer vacation, student teaching, and the re-training of the workshop. (2) The workshop constituted the single phase of the professional sequence of elementary education students which was accompanied by the greatest change in their attitudinal level. Since this change was positive in nature, the workshop would appear to be an efficient and economical method of re-training. (3) An interruption of three months in the professional program of elementary education students after one semester of concentrated training in methodology was accompanied by a reversion to an attitudinal level not statistically different from their level prior to training. (4) The leadership of supervising teachers who were ranked "low" on the MTAI was associated with retardation in the attitudinal growth of their student teachers during the workshop. (5) A broader basis for the formation and retention of professional attitudes might be provided by a closer integration of psychology and methods courses and by a fuller exploitation of the pre-student teaching experiences with children. (6) Mediation of the loss in the attitudinal level of trainees during student teaching might be effected by greater discrimination in the selection of supervising teachers, and by inservice training of supervising teachers.

Microfilm $2.00; Xerox $5.20. 101 pages.

TRENDS IN THE PREPARATION OF TEACHERS FOR THE ELEMENTARY SCHOOLS AT THE NEW JERSEY STATE TEACHERS COLLEGE AT TRENTON 1855-1956

(L. C. Card No. Mic 58-5725)

Evelyn Birdsall Franz, Ed.D.
Rutgers University, 1958

I. THE PROBLEM

Statement of the problem. It was the purpose of this study (1) to discover significant changes and interpret some of the trends in the curriculum for the preparation of elementary teachers from 1855 to 1956 in the New Jersey State Normal School, now the New Jersey State Teachers College at Trenton; and (2) to identify issues which need to be resolved in evaluating the present program and in adapting it to future needs.

In order to discover significant changes, it was necessary to study the relationship of certain general policies of the institution to the evolution of the curriculum and to consider such questions as the following: What were the general objectives of the College? What were the admission requirements? Who was responsible for curriculum making? What was the content and organization of the curriculum? What emphasis was placed upon "general education" and "professional education"? What was the nature of professional laboratory experiences offered in the curriculum?

II. METHODS AND PROCEDURES

The writer read all of the catalogs, bulletins, and publications of an official nature concerning the developments of the New Jersey State Normal School and later the State Teachers College at Trenton, for the one hundred year period to discover the academic years during which developments were occurring that affected the education of the preservice teachers in the Elementary and Kindergarten-Primary curriculums. Certain years were significant and were chosen for intensive study.

The data with regard to the relationship of certain general policies of the institution to the evolution of the curriculum, particularly the (1) general objectives of the institution and (2) admission requirements, were treated in separate chapters. The century of development could be divided into four different periods in which certain curriculum patterns were in force. Consequently, separate treatment was given to the content and organization of the curriculum from (1) 1855 to 1900; (2) from 1900 to 1927; (3) from 1927 to 1956; and (4) the present curriculum adopted in 1956.

The catalogs, bulletins, publications of an official nature concerning the institution, and the Diary, written by one of the first fifteen students while enrolled in the Normal School (1855-1857), were examined. Information was selected from other sources, and was supplemented by comparable data from other studies.

Tables were prepared to show the changes which occurred in the curriculum.

III. SUMMARY AND CONCLUSIONS

Throughout the one hundred year period, the New Jersey State Normal School, and later the New Jersey State Teachers College at Trenton, adopted innovations in curriculum design in response to the changed needs and demands of public schools. Important changes and trends were found to be the following:

1. The State Teachers College at Trenton has been dedicated to the preparation of teachers for the public schools for the past century. From its inception, institutional objectives have remained relatively constant although the methods of reaching these objectives have changed. These changes were made as the preparation for teaching increased, and as the demands of society were reflected in the schools.

2. Emphases have been placed upon the preparation of qualified teachers with a tendency toward increasing the actual period of preparation from two to three years, and, later, to four years. The lengthening of the period of preparation was made possible when requirements for admission to the Normal School were increased from completion of grammar school to graduation from a four-year high school.

3. There has been a noticeable clarification, extension, and refinement of admission requirements,

from practically none, to the current set of weighted criteria.

4. General education for teaching has been considered a very important part of professional preparation although the proportion of general to professional education has fluctuated from period to period. As content was enriched, and as functions of the elementary and secondary schools multiplied, it became increasingly apparent that the teacher had need of a broader general education. The impact upon the curriculum was traced throughout the period. Currently, approximately two-thirds of the work prescribed is devoted to general education. In addition, time is allotted within the program for cultural experiences and activities to provide for enrichment.

5. During the first seventy-five years, professional courses dominated the curriculum. These included methods courses, history of education, school management and psychology. Approximately three-fourths of the total preparation was professional in nature. During the last twenty-five years, there has been a pronounced change in the proportion of professional education courses offered, in that approximately one-third of the time is devoted to professional education.

6. During the first seventy-five years, both general and professional education courses were prescribed throughout the course of study, the belief being that professional experience should come early in the pattern. During the last twenty-five years, there has been a tendency to concentrate the general education courses in the first two years, with diminishing emphasis in the last two years.

7. From the beginning, the importance of professional laboratory experiences has been recognized. Such experiences have been provided by having students observe children and practice in the facilities provided for this purpose. The patterns of this observation and practice have varied throughout the years, but there has been a consistent effort to correlate educational theory with practice.

8. The modern curriculum now requires a core of general and professional courses, and for the first time in the history of the College, enables a student to select twelve semester hours of "unfettered" electives.

9. Until 1926 the major responsibility for curriculum making was vested in the principal of the Normal School. Presently, curriculum making is a democratic endeavor involving educators, many selected citizens at the local and State levels, administrators, faculty, and students.

10. In view of the broad purposes and understandings as outlined in the objectives of the College, it may be concluded that if the institution is to exert educational leadership, and meet in a satisfactory manner the responsibility that is inherently its own, provision should be made for constant review of the program of studies. Emerging issues warrant careful consideration. These are the following: If the New Jersey State Teachers College offers curriculums other than those in the education of teachers, what effect will this have on the curriculums in teacher education? Are five years of post high school preparation desirable for the preparation of teachers? If so, what should be the content and organization of a five-year program? How can admission procedures, which seem to be fairly effective at present, develop closer working relationship with high school staffs to ensure the College of good students? Is it possible to develop better measurement of the relationship of the admission program to achievement in college and success in teaching? How can the curriculum committee establish and maintain a line of communication which will involve all staff and faculty in curriculum study, and provide for a continuous evaluation of the curriculum? What evidence is there that the College is developing a general and professional education program which is in keeping with its stated objectives? Where in the sequence, should general and professional education courses be placed? What should be the nature of professional laboratory experiences? How will guidance for all students be made possible?

Microfilm $5.90; Xerox $20.60. 462 pages.

A COMPARISON OF COLLEGIATE ACHIEVEMENT BETWEEN SELECTED TECHNICAL-VOCATIONAL HIGH SCHOOL AND SELECTED GENERAL-ACADEMIC HIGH SCHOOL GRADUATES IN THE INDUSTRIAL ARTS TEACHER EDUCATION PROGRAMS IN NEW ENGLAND

(L. C. Card No. Mic 59-3843)

Everett Edward Koehler, Ph.D.
The University of Connecticut, 1959

Problem- The purpose of this study was to compare the collegiate achievement between selected technical-vocational high school graduates with selected general-academic graduates in the industrial arts teacher-education programs of New England.

Procedure- From the personal folders of 160 students, who comprised the graduating classes of 1952 and 1953, in the four New England state teachers colleges where industrial arts was offered, data were taken relative to certain subjects. Representative subjects in general, technical and professional education were selected. The 104 students in the general-academic group were equated with the 56 students in the technical-vocational group with the use of their I.Q. ratings. Variance in achievement between the two groups was analyzed using the F test technique to determine if this variance was significant at the 1% level. The variance between the two groups was tested in each subject within each college, and then as two total groups.

Findings and Conclusions- The achievements of the general-academic students and the technical-vocational students did not vary enough in any of the technical subjects to be significant at the 1% level. The greatest tendency toward variance in the technical area was in power-mechanics, and the smallest F-value, indicating the least variance, was in drawing. In the general education area the F-values were relatively high throughout the four colleges, and high enough in English to be significant at the 1% level at one college. The second highest F-value in the general area was in mathematics, although it was not high enough for significance. Grades earned in professional education had a definite tendency to be higher than in general and technical education, and both groups achieved with practically equal success in this area. It can be concluded that, with the exception of English, these two groups of students will not vary in collegiate achievement enough to be significant in the industrial arts teacher education program. Special courses in English can be

offered as part of the freshman program to those students who need help in this subject. The results of this study indicate that all secondary schools should be investigated for the best candidates for industrial arts teacher education. The mastery of high school programs rather than the type of high school program should be the primary concern of recruitment personnel for industrial arts teacher education institutions.

Microfilm $2.00; Xerox $5.60. 113 pages.

ASSOCIATIVE FACTORS IN CHANGES OF STUDENT TEACHERS' ATTITUDES DURING STUDENT TEACHING

(L. C. Card No. Mic 59-4279)

Robert Vance Osmon, Ed.D.
Indiana University, 1959

Chairman: Howard T. Batchelder

The Problem

The purposes of the study were as follows:

1. To determine whether there was a significant change in the student teachers' attitudes during student teaching, as measured by The Minnesota Teacher Attitude Inventory.
2. To check the relationship between an increase in attitude scores of the student teachers and an expressed opinion as to the satisfactory-unsatisfactory nature of the student teaching experience.
3. To explore some of the factors in the student teaching experience that were associated with a change in the attitude scores of the student teachers.

Procedure

The professional literature was reviewed in these areas:

Problems of student teachers, measurement of attitudes, and attitude measurement by the MTAI.

During the second semester of the 1956-1957 academic year at Indiana University, 222 secondary student teachers were tested with Form A of the MTAI before their student teaching experience and again near the end of their student teaching experience.

From the test scores, 20 student teachers whose MTAI scores increased and 20 student teachers whose MTAI scores decreased during student teaching were selected to be interviewed.

An interview guide was constructed and used in interviewing the 40 student teachers. The interview guide facilitated the researcher's efforts in exploring those factors in the student teaching experience that were associated with a change in the attitude scores of the student teachers.

The results of the testing and interviewing phases of the study were treated, compared, and analyzed with appropriate statistical procedures. The findings were reported and conclusions were drawn based upon the limitations of the study.

Findings

The major findings were as follows:

1. It was determined by means of the "t" test statistic that the mean MTAI scores of all the students showed a loss in mean MTAI points at less than the one per cent level of significance during the student teaching experience.
2. By means of the chi-square statistic, there was found to be a significant difference at the five per cent level of probability in the responses of the students whose MTAI scores increased during student teaching and the students whose MTAI scores decreased during student teaching concerning the satisfactory-unsatisfactory nature of their student teaching experience.
3. Little to no relationship was found to exist between an increase or decrease in MTAI scores during student teaching and the following factors:
   a. An opportunity to participate in a supervisory role in the extracurricular program of the school.
   b. Restrictions that the student felt were placed upon his freedom to participate in personal activities away from the school.
   c. Extreme difficulty with problems of classroom management.
   d. Inadequate classroom facilities.
   e. Poor interpersonal relationships within the classroom.
   f. Adequacy of the subject-matter preparation of the student teacher.
   g. Difficulty in adjusting to the role of a teacher.
   h. Unfavorable reaction of the student teacher to the moral standards of the pupils.
   i. Descriptions of the teaching personality of the supervising teacher as seen by the student teacher.
4. The following factors were found to be consistently associated with a loss in MTAI scores during the student teaching experience:
   a. A felt difficulty in motivating the pupils.
   b. Difficulty with pupil control and discipline.
   c. A belief that the pupils were not achieving commensurate with their abilities.
   d. A belief that the pupils had cooperated very poorly.
   e. A belief that the supervision by the supervising teacher had been inadequate.
   f. A decision not to seek a teaching position the following school year.

Microfilm $5.35; Xerox $18.80. 419 pages.

AN ANALYSIS OF THE PROBLEMS OF THE MALE STUDENT TEACHER IN PHYSICAL EDUCATION WITH IMPLICATIONS FOR PROGRAM PLANNING: (AS APPLIED TO STATE UNIVERSITY OF NEW YORK TEACHERS COLLEGE AT CORTLAND, NEW YORK)

(L. C. Card No. Mic 59-1942)

Anthony Paul Tesori, Ed.D.
New York University, 1959

Chairman: Professor Leonard A. Larson

The problem was to identify and analyze the student teacher problems, propose solutions, and determine what the college at Cortland can do to implement these solutions. The significance of this study lies in the fact that many of the student teacher problems can be prevented in the pre-student teaching period.

A total of one hundred three problems was listed under seven headings and incorporated into two checklists. The checklists were utilized in conjunction with interviews conducted with forty-six male student teachers, twenty-six sponsor school administrators and sponsor teachers, and three college supervisors to determine frequency and urgency of the problems. Seventy-nine were regarded as no problem and twenty-four as problems of some importance.

These problems were submitted to a jury along with a list of standards and practices employed at Cortland to determine the standard or practice most responsible for each problem.

Personal interviews were conducted with members of the Division of Health and Physical Education of the State Education Department of New York State. Legal aspects relative to student teaching were handled through correspondence with the Legal Division of the State Education Department.

Periodical literature carrying information relative to student teaching was analyzed and summarized to determine trends.

A study of certification requirements, in-service study and training requirements, and Education Law as it affects student teaching was conducted through personal interview and correspondence at the state, college, and sponsor school levels.

The student teaching standards were evaluated and compared with standards developed in the Ames study by means of qualitative and quantitative analysis to determine the inadequacies of the student teaching program.

The standards, aside from re-stating them in a more specific manner, appear adequate. The failure lies in implementing suitable practices. There is a need for all persons associated with the student teaching program to confer and discuss ways of strengthening the practices.

The investigation indicates that the student teaching program at Cortland is functioning effectively in bridging the gap between theories of professional training and practices of a typical teaching situation. The following recommendations are offered for improving the student teaching program for physical education men at Cortland.

1. Greater emphasis be given to practical and realistic experience on campus.
2. Activity courses conducted to provide not only improved skills, but also organizational techniques, methods and materials applicable to various grade levels.
3. Seminars conducted concurrently with the student teaching experience.
4. The number of student teachers per college supervisor be limited so that frequent visits to the student teacher are possible.
5. The extra responsibilities of the college supervisor be such that they will not interfere with his primary responsibility to the student teacher.
6. The sponsor schools selected so as to insure suitable experiences for the student teacher.
7. Sponsor school personnel carefully oriented to their role and required to participate in workshops and seminars.
8. The student teaching standards be re-stated. This to be accomplished through the joint efforts of the administration and others directly responsible for the student teaching program.
9. The standards published and made known to faculty, sponsor school personnel, and students.
10. Student teachers granted "special temporary certification" to enable the student teacher to assume a more realistic role in the off-campus experience.
11. The off-campus student teaching experience be lengthened.

Microfilm $3.75; Xerox $8.80. 291 pages.

EDUCATION, THEORY AND PRACTICE

EVALUATION IN SOCIAL STUDIES CLASSROOMS: IDEALS AND PRACTICES

(L. C. Card No. Mic 59-3661)

Dwight William Allen, Ed.D.
Stanford University, 1959

Nineteen hundred teachers were selected at random from the membership of the National Council for the Social Studies to participate in this national study of evaluation practices in the social studies. Each teacher received a questionnaire which contained sixty-eight questions on all phases of evaluation. A total of more than six hundred replies were received, which constituted a sample of more than ten percent of the organization.

The data were tabulated by the use of electronic computing equipment which made possible extensive cross-tabulation.

Respondents were asked to reply under three conditions: (1) would it be ideal (regardless of whether or not it is currently reasonable), (2) is it reasonable now (under current teaching circumstances in their school), and (3) is it their practice. Since it was anticipated that teachers asked to respond to three different circumstances might distort their responses as a result of the artifact of the questionnaire, three forms of the questionnaire were used.

It was found that teachers asked to respond to all three conditions admitted to more variation between ideal and practice than did those teachers asked only to respond to one or the other singly.

There were some direct implications for both pre-service and in-service education for teachers. The statistical neatness of objective tests and numerical averaging lends an aura of exactness to the grading process and disguises the many subjective elements which are anterior components. So many of the social studies objectives are vague and ambiguous that many specific objectives which are readily measurable (such as skill areas) are obscured. Tests have been regarded as a panacea of evaluation, and teachers have automatically turned to tests whenever evaluation is considered necessary. Teachers regard evaluation as an unfortunate appendage of teaching, rather than as an integral part of it. So long as teachers do not comprehend the integral relationship of the full range of evaluative techniques with teaching objectives and activities, evaluation will never be utilized in its full potential.

Some of the more important conclusions are summarized below:

1. Teachers are often inconsistent in their conception of evaluation.
2. Teachers are reticent, both ideally and in practice, to use the full range of evaluation techniques now available to them.
3. Teachers place a great amount of blind faith in the indirect accomplishment of their objectives.
4. Teachers have a very low level of statistical sophistication.
5. Teachers almost unanimously accept both essay and objective test items.
6. The theory of sampling in test construction is not understood by teachers.
7. Teachers, by their practices, encourage students to regard grading as a coercive weapon to be used against them.
8. Very few teachers perceive many of the major implications of the evaluation program which go beyond the grading of students.
9. Practices of evaluation are more limited by teachers' concepts of ideal practice than by classroom conditions.

Experimental evidence is needed, but in the meantime teachers should utilize the best a priori assumptions which are better than pure conjecture. Teachers should re-examine the purposes of evaluation and their relationship to the entire teaching program.

Microfilm $4.10; Xerox $13.80. 317 pages.

FILMED DEMONSTRATIONS FOR INDUSTRIAL ARTS: SOUND MOTION PICTURES OF SELECTED INDUSTRIAL ARTS DEMONSTRATIONS WHICH MAY BE USED AS A TEACHING DEVICE

(L. C. Card No. Mic 59-1933)

Charles E. Ball, Ed.D.
New York University, 1959

This project was carried on for the purpose of preparing filmed demonstrations that could be used in a study designed to determine the value of motion picture films in the teaching of industrial arts manipulative activities. The project consists of twenty-two sound motion picture films of industrial arts shop demonstrations. Each demonstration is one reel or less in length.

The films were produced by the investigator using equipment that is commonly available to teachers in well equipped audio-visual laboratories. The sound was added to the films after the films had been edited, using the magnetic stripe method. The demonstrators in the films are staff members of the Department of Vocational Education of the School of Education of New York University. The films were made on single perforated sixteen millimeter black and white reversal film.

The demonstrations which were filmed were selected from those that are usually found in industrial arts programs. Several state syllabi were used as a basis of selection. Final selection was made by the investigator and members of the Department of Vocational Education of the School of Education of New York University. The films deal solely with the manipulative skill aspect of the industrial arts demonstration. Related information was deliberately eliminated from the films so that it would not interfere with future studies designed to evaluate the use of these or similar films as a means of teaching industrial arts manipulative skills.

The films were evaluated by the members of the Department of Vocational Education of the School of Education of New York University, using an evaluation instrument that utilized a check rating sheet which, at least to some degree, objectified the subjective opinions of the group. The primary purpose of the evaluation instrument was to determine the degree of acceptability of the films, taking into consideration seventeen factors which were believed to be important when rating a demonstration. It is entirely possible that the instrument is subject to question in that the scores for the films are high and the range or spread of scores is small.

The investigator is of the opinion that this project is only a first step in a large research project. These films may serve as a tool to be used in a study to determine whether or not it is feasible and practical to use motion picture films for the teaching of some of the manipulative skills in industrial arts education.

Microfilm $2.00; Xerox $6.60. 138 pages.

INTER-PROFESSIONAL DIFFERENCES IN BELIEFS ABOUT THE ETIOLOGY OF JUVENILE DELINQUENCY: A COMPARATIVE STUDY WITH IMPLICATIONS FOR EDUCATION

(L. C. Card No. Mic 59-3694)

William Dienstein, Ph.D.
Stanford University, 1959

This study was concerned with the beliefs about the etiology of juvenile delinquency held by teachers of elementary public schools, juvenile police officers, and juvenile probation officers, as personnel of three public agencies concerned with the prevention and control of juvenile delinquency.

To determine the degree of common understanding about the etiology of juvenile delinquency that existed among the personnel of the three public agencies selected for this study, an instrument was developed which contained two tasks designed to measure (1) beliefs about the causes of juvenile delinquency held by the respondents, and (2) meanings given to causal Statement about juvenile delinquency.

The instrument contained a Check-List of 35 Statements setting forth "causes" of delinquency. The Statements were derived from the literature and were selected for the Check-List on the basis of classification into categories by pretesting a group of experts on juvenile delinquency and a group of elementary and secondary public school teachers. The respondents were directed (1) to accept or reject each Statement, and (2) to classify each Statement into one of four etiological categories.

The Check-List was administered to 484 respondents. The teacher sample consisted of 74 elementary public school teachers, 114 junior high school teachers, and 64 senior high school teachers, a total of 252 elementary and secondary school teachers from the Fresno Metropolitan area. The juvenile police officer sample consisted of 131 juvenile police officers from the Los Angeles City Police Department. The juvenile probation officer sample consisted of 101 juvenile probation officers from the Los Angeles County Probation Department.

The findings showed that among the personnel questioned there existed (1) marked differences in opinions about the causes of juvenile delinquency and (2) a wide variety of interpretations of the meanings of etiological Statements.

These findings indicated a lack of common understanding of the current knowledge about the etiology of juvenile delinquency among the personnel of the three agencies considered.

The data provided by this study can be utilized by educational institutions to provide a fruitful approach for improvement of curricula, and by professional organizations of the three agencies to direct the attention of their membership through various media to the existence of this lack of common understanding and to provide suggestions and programs for improvement.

Microfilm $2.55; Xerox $8.80. 195 pages.

AN APPRAISAL BY INDIANA EDUCATORS OF THE EDUCATIONAL VALUE OF PROPOSED AUDIO-VISUAL STUDENT ASSISTANT ACTIVITIES

(L. C. Card No. Mic 59-4276)

Kenneth Gene Faris, Ed.D.
Indiana University, 1959

Chairman: Virgil Schooler

Problem: The major purpose of this study was to determine the educational values to be derived by secondary school students from participation in the operation of an audio-visual program. A subsidiary purpose of the study was to determine the status of audio-visual student assistant programs in secondary schools in Indiana.

Procedure: A review of the literature concerning student participation in the operation of building audio-visual programs was made. Based on this review, six major activities were identified which audio-visual student assistants are participating in to varying degrees. These six activities were evaluated, by a jury of Indiana educators, in light of the contribution student performance of them could make to the achievement of the "Imperative Needs of Youth of Secondary School Age." A combination interview-questionnaire approach was used to elicit the opinions of the jury. The jury consisted of 51 audio-visual coordinators, 51 secondary school principals, 15 college professors in audio-visual communications, and 15 college professors in secondary education. The medians of the jury's responses, in conjunction with the median test, were used in analyzing the data. The subsidiary purpose of the study was accomplished by interviewing the coordinators concerning the status of their audio-visual student assistant programs.

Major Conclusions: 1) In general, the opinions of the judges indicated that an audio-visual student assistant program, consisting of the six activities outlined in this study, can be justified on the basis that the participating students are afforded an opportunity to develop the following competencies: (a) to develop salable skills and proper work attitudes through supervised work experiences; (b) to develop an understanding of the rights and duties of a citizen in a democratic society; (c) to develop an understanding of how to purchase and use goods and services intelligently; (d) to develop an appreciation for the aesthetic things of life; (e) to develop the ability to utilize leisure time constructively; (f) to develop respect for other people and to learn to work cooperatively with others; and (g) to develop the ability to communicate effectively with others.

2) The opinions expressed by the judges in the study failed to clearly indicate that any one activity would be more valuable than another in achieving the ten imperative needs. In the limited cases where the activities could be ranked, photography seemed to be the most valuable activity with operation and care of equipment being the next most valuable.

3) The judges had opinions concerning the value of the audio-visual student assistant activities, but in very few cases did they express an intense belief concerning the relationship between an activity and a need.

4) Secondary schools in Indiana are using students to a limited extent in the operation of their audio-visual programs. Where they are being used, it is primarily for the purpose of operating audio-visual equipment.

Microfilm $4.25; Xerox $14.20. 329 pages.

A MANUAL OF FUNCTIONAL LESSON PRESENTATIONS FOR TEACHERS OF INDUSTRIAL ARTS, WITH EMPHASIS ON PUPIL UNDERSTANDING

(L. C. Card No. Mic 59-1935)

Abraham Meyer Finkelstein, Ed.D.
New York University, 1959

Chairman: Professor William P. Sears

The Problem and Its Significance

The purpose of this study was to develop a manual, functional in design and purpose, in the field of industrial arts. Criteria for the content of lessons were determined from the literature in the field and a survey was taken in New York City to identify those presentations in the areas of general crafts, general electricity, general metalwork, general woodwork and graphic arts which were most difficult for pupils to understand. Twenty-five lessons were devised and were subjected to field trials.

The importance of a manual of lesson presentations which aims at the increase of pupil understanding is in the extent to which present educational experiences are as educationally sound as they should be. Many teachers, still following outdated methods, tend to lead pupils to substitute memorization for meaningful learning. Demands have been made by writers in the field calling for an improvement of teaching techniques. The presentations include techniques and procedures which can be of material aid to teachers in their efforts to increase pupil understanding.

Methods Used

To answer the question which arises concerning the content of an industrial arts lesson presentation in order for it to be a source of maximum understanding to pupils, a group of criteria was formulated from existing literature in the fields of general education and industrial arts education.

Demonstration lessons and related information lessons as listed in certain courses of study were included in a questionnaire circulated among one hundred seventy-nine teachers, divided among the five teaching areas. In addition, lessons receiving the highest teacher ratings in each area were submitted to juries consisting of faculty members of the Industrial Arts Departments of the Schools of Education of both New York University and City College, and to the supervisory staff of the Bureau of Vocational Activities of the New York City Board of Education.

An intensive search was then made for what would finally constitute the content of the devised lessons. This was done by discussion with teachers, by attending meetings of professional organizations, by observing lessons being presented, by visiting cultural centers and by doing research in industrial brochures, curriculum bulletins, teachers' guides, work manuals and textbooks. As ideas presented themselves, they were checked against the criteria and either tried in practice or discussed with colleagues, before being included in the content of the lesson.

To determine the operational validity of the lessons, fifteen teachers in three schools participated in field trials. Two classes, scheduled to each teacher, were given a pre-test. One trial class was given the devised lessons while the comparison class was taught the lessons usually given by the teacher. Short tests were then given to pupils after which teachers compared the devised lessons with their own lessons.

Findings

Teachers experienced most difficulty in teaching lessons dealing with relationships and with design, planning and measurement. Furthermore, there seemed to be a close inverse relationship between the difficulty of teaching a lesson and the small degree of interest shown by pupils. The basic conclusion of the study was that, since the participating teachers rated the devised lessons higher than their own by more than a reasonable degree, the manual, generally speaking, was functional and operationally valid. Microfilm $6.00; Xerox $20.80. 470 pages.

AN ANALYTICAL STUDY OF TWELVE MICHIGAN COMPREHENSIVE HIGH SCHOOLS

(L. C. Card No. Mic 59-3925)

Rabindra Nath Ghosh, Ph.D.
University of Michigan, 1959

The two general purposes of this study were: (1) to determine the status of the course offerings in twelve Michigan comprehensive high schools and (2) to discover if two groups of students--college preparatory and non-college preparatory--enjoyed parity of esteem in the social and academic situations in these schools.

Five hypotheses were tested within the framework of these purposes: (1) The course offerings in the Michigan high schools under study were varied enough to give the students a sufficient opportunity to select courses suited to their abilities and needs. (2) The guidance needs of the students, arising out of the fact that the school had a varied student population were being met. (3) The high schools fostered parity of esteem between the college preparatory and non-college preparatory students. (4) The extra-curricular activities were, for the most part, dominated by college preparatory students. (5) Principals of these schools had an implicit faith in the comprehensive school idea.

The data for the study were secured from interviews with the principals and guidance counselors and questionnaires administered to the tenth and twelfth grade students in the twelve high schools. The analysis of the data was organized along two lines: (1) in the form of a comparison between the college preparatory and non-college preparatory groups and (2) by schools showing the characteristic features of individual schools and comparing the metropolitan group of schools with the out-state group of schools.

Two general conclusions could be drawn from the study: (1) The curricular offerings in the high schools under study were found to be extensive enough to give the students

a sufficient opportunity to select courses suited to their abilities and needs. (2) The college preparatory and non-college preparatory groups of students showed differences, though slight, in their composition and outlook. Whether or not these differences rendered their living and studying together incompatible could not be conclusively inferred from the available data.

Specific conclusions relative to the hypotheses tested are as follows: (1) In all the schools the course offerings covered the areas commonly referred to as academic or college preparatory, general, and practical arts or vocational. (2) All the schools had a functionally good guidance program and one of them had an outstanding program. (3) The majority of the students, principals and guidance counselors considered the curriculum as of no consequence in the matter of student prestige. (4) In sports activities the level of participation by the college preparatory and non-college preparatory students was equal but in other activities, as well as in leadership positions, the college preparatory students showed a significantly higher level of participation. (5) All the principals were convinced that the comprehensive type of school was best suited for providing adequate education in a democratic setting.

Microfilm $4.45; Xerox $15.00. 348 pages.

PHILOSOPHICAL ANALYSIS AND A CONCEPT OF UNITY AS BASES FOR LIBERAL EDUCATION

(L. C. Card No. Mic 59-3645)

Ronald G. Jones, Ed.D.
The University of Buffalo, 1959

The purpose of this study was to develop a theory of philosophical analysis and a concept of unity and demonstrate how they may serve as the bases for liberal education.

A review of the literature showed slight justification for distinguishing sharply between general and liberal education or between liberal and vocational education. Further, there is a lack of both nominal and substantive agreement concerning the nature of liberal education. Different terms are used to signify the same concept and the same term is often used to signify many different concepts. While there is some agreement on very generally defined goals, as the means-ends hierarchy is descended there is less agreement with respect to intermediate ends, and still less in the area of means.

Within the area of intermediate ends there is a measure of agreement concerning the desirability of some kind of integrating or unifying concept. There is also some consensus that critical thinking should serve as the integrating concept. However, there is scant agreement concerning the nature of critical thinking and how it is to be accomplished.

This study considered the problem of integration in education as a specific manifestation of the philosophical problem of unity, the problem of the one and the many. Similarly, philosophical analysis is a more general theory of analysis than its educational counterpart, critical thinking. By this philosophical approach insight was gained into the educational problems of integration and critical thinking.

Philosophical analysis was defined in terms of Aristotelian induction and later developments in isomorphic mapping and analogical reasoning. It was shown that this concept of analysis enjoys nearly a one-to-one correspondence with certain concepts in psychological growth and development theories and learning theories. This was accomplished through the concept of mediation.

In order for the concept of philosophical analysis to serve as the integrating concept without introducing conformity, it was necessary to develop a theory of unity that would allow for diversity. Thus, in terms of the means-ends distinction, diversity without unity exists wherever the ends are different as well as the means being different. Conformity exists when the ends are the same and the means are the same. However, if the ends are the same and the means are different, there is unity amidst diversity. Broader implications of the concept of unity were indicated in the study. These were defined in terms of outlooks and attitudes so often alluded to as objectives of liberal education.

Avoiding either of the extremes, conformity and diversity, required a concept of unity such that philosophical analysis may be accomplished in different ways. In terms of the distinction between necessary and sufficient causes, it was argued that while philosophical analysis is a necessary cause of liberal education, it is not necessary and sufficient. What is sufficient must be determined according to the specific needs of a particular time and place. Whether one subject matter or approach is more appropriate than another must be determined on the bases of experimental and empirical studies.

Liberal education, then, is defined in terms of philosophical analysis and the concept of unity discovered through its application. These constitute method and outlook, power and wisdom.

General applications of the concept of unity were made in the areas of teaching methods and curriculum development. The problem was to show how application of this concept makes it possible to bring a measure of order into methodological and curricular diversity. Also, as an indication of the already implicit acceptance of the concept of philosophical analysis in certain areas, the use of paradigms in educational administration theory and sociological theory was reviewed.

Microfilm $2.40; Xerox $8.40. 182 pages.

PUBLIC EDUCATION IN EGYPT: PRACTICE AND THEORY

(L. C. Card No. Mic 59-3866)

Philip Saber Saif, Ph.D.
The University of Connecticut, 1959

The Purpose

The purpose of this study is to develop recommendations for a system of education consonant with the needs of the people of contemporary Egypt.

The Procedure

This study has been divided into three main parts:

I. A historical background of education in Egypt since

ancient times. This material up to 1937 has been covered in chapter two. This chapter shows that education in Egypt came as a hybrid of French, English, and Egyptian influences.

II. A description, in some detail, of the patterns of organization of Egyptian education from 1937 to the present. This era has been divided into three subdivisions:

a. Chapter three describes the system of education between 1937 and 1939. This date has been chosen because in that year the Ministry of Education in Egypt began to apply decentralization. It is therefore a landmark in the history of education in Egypt.

b. Chapter four explains the patterns of education from 1939-1952. This chapter shows a state of confusion and inconsistency in a period when there was no stable policy for education in Egypt.

c. The 1952 revolution resulted in substantial changes in Egyptian education. These changes were of short duration. In 1956 the system of education was reorganized. Chapter five deals with these two changes.

As teachers are an important factor in education, chapter six has been devoted to the development of teachers' preparation.

III. The last part of this study is composed of chapters seven and eight. Chapter seven is the summary and findings while chapter eight gives recommendations for the educational system in Egypt. It was found that the existing system of education does not fulfill the ideals that Egypt has set. These are the democratic ideals. Equality of opportunity, according to the existing system, is not fully enjoyed. Written examinations play an important role in determining the future of the child. Also, it has been found that freedom in the individual schools is greatly restricted because of the higher authority, that is the Ministry of Education. In addition to the above points, teachers differ in their preparation: some are poorly prepared while the preparation of others is more adequate. In both categories a dynamic in-service training is lacking.

The Conclusion

This study leads to certain recommendations that can be summarized as:

1. One primary school for all children: retarded, average, and accelerated, both boys and girls.
2. Comprehensive preparatory and secondary schools.
3. Changes in curriculum that will help the individual and society to develop dynamically.
4. The heightening of the level of teacher-training regardless of the level on which the individual is preparing to teach.
5. Plans should be developed now to meet the demands of the future increase in the number of required years of fundamental education.
6. Decentralization should be applied even in the individual schools. This involves abolishing the system of inspectors and developing effective relations between school and community.

Microfilm $2.75; Xerox $9.40. 209 pages.

THE EFFECT ON LEARNING OF TWO TYPES OF FILM INTRODUCTIONS IN NINTH-GRADE GENERAL SCIENCE

(L. C. Card No. Mic 59-2088)

Milton Schulman, Ph.D.
New York University, 1959

Chairman: Associate Professor Elwood J. Winters

The main purpose of this investigation is to study the relative effects of positive or negative introductory sequences of a selected instructional film, upon the immediate recall and delayed recall of factual information learned from the film by 2 similar groups of ninth-grade general science pupils.

The two types of introductory sequences produced by the investigator and approved by a competent jury of educators, serve as alternate introductions (incorporated into the film) to the 16mm sound film, and are designed in such a fashion as to produce varying stimulation to the viewer to acquire the factual material imparted by the film.

The two versions of introductory sequences consist of the following:

1. Negative Introductory Sequences--the auditory and visual portion of the film which begins the presentation and runs up to the beginning of the body of the film and which shows the viewer a means of avoiding an unpleasant consequence that he is already stimulated to avoid. For example: such consequences as death, illness and rejection by peers.

2. Positive Introductory Sequences--similar in film structure to above, but which shows the subject a means to a pleasant goal that he is already stimulated to achieve. For example: such goals as good health, good looks, acceptance by peers.

A secondary purpose of the investigation is to study the relationships between the effects produced by each version of film introduction on learning from the film, and the intelligence quotient and sex of the pupil.

The subjects consisted of general science pupils of the Charles E. Nichols Jr. High School, Mount Vernon, New York. Male and female subjects were randomly selected and assigned to two groups.

Under similar conditions, one group (Group I) saw the entire film including the positive introductory sequences, while the other group (Group II) viewed the entire film incorporating only the negative introductory sequences. The effectiveness of the differing introductory versions was appraised by means of a series of especially prepared subject-matter tests.

An Outline of the Experimental Procedure

Subjects	Group I	Group II
Number	145	145
	I.Q. Test	I.Q. Test
Mon. Nov. 18th	Pretest	Pretest
Mon. Dec. 2nd	Viewed film containing positive introductory sequences and factual information part of film.	Viewed film containing negative introductory sequences and factual information part of film.
	Post-test (immediately after film)	Post-test (immediately after film)
Mon. Dec. 16th	Delayed test	Delayed test

The data were analyzed using the analysis of variance technique. Significant values of F were further examined by means of t-tests.

The findings are revealed by a comparison between the viewers of the film containing the positive introduction and viewers of the film bearing the negative introduction.

1. Positive introductory sequences incorporated within a science film result in greater factual learning from the film, as measured by an immediate recall test.

2. Negative introductory sequences contained within a science film result in greater retention of factual information learned from the film, two weeks after film viewing.

3. Male viewers of a science film containing positive introductory sequences learn more from the film in terms of immediate and delayed recall than male viewers who see the film bearing negative introductory sequences.

4. There is no significant difference in learning from a science film, in terms of immediate and delayed recall, between females who view the film containing negative introductory sequences and males and females who see the film containing positive introductory sequences.

5. Two weeks after film viewing, pupils with an "average" I.Q. retain significantly less of what they knew immediately after film viewing, as compared with "superior" and "inferior" I.Q.s.

6. Irrespective of type of introduction, and in terms of immediate recall, viewers with an "average" I.Q. profit most from a science film, followed by the "inferior" and "superior" I.Q.s.

7. Film learning takes place irrespective of whether the instructional science film contains positive or negative introductory sequences.

Microfilm $2.00; Xerox $6.60. 138 pages.

THE ROLE OF MATURITY IN ACQUIRING A CONCEPT OF LIMIT IN MATHEMATICS

(L. C. Card No. Mic 59-3671)

Lehi Tingen Smith, Ed.D.
Stanford University, 1959

The purposes of this study were to determine (1) the relative importance of maturity as compared to experience in acquiring a concept of limit, (2) whether or not junior-senior high school students can acquire a concept of limit to a measurable degree, and (3) the correlations between the extent to which junior-senior high school pupils have conceptualized the limit in mathematics and their (a) chronological ages, (b) mental ages, and (c) grade point averages in mathematics classes. Inferences were drawn from such answers as were obtained to these questions for junior-senior high school mathematics curricula.

The population studied was five hundred seventy-eight pupils from grades seven through twelve who were currently enrolled in mathematics classes. All classes were given the Limits Test, an instrument designed through cooperative effort especially for this investigation. Data were also obtained on chronological age, mental age, and grade point average in mathematics classes for every subject.

Some classes at grade levels seven, nine, and eleven were given three hours of special instruction with problems involving the concept of limit. These were classified as experience classes. The other classes, which received no special instruction, were classified as non-experience classes.

Mental age was found to be an acceptable basis for equating groups. At each of the given grade levels, seven, nine, and eleven, the experience and the non-experience classes were equated as to distribution of mental age. Significant differences in mean Limits Test scores were interpreted as being a consequence of the special instruction.

Correlations were computed at all grade levels between the measure of the extent to which the subjects had conceptualized the limit in mathematics and their chronological ages, mental ages, and grade point averages in mathematics classes.

The findings were organized to provide answers to the problems above. (1) The evidence indicates that experience is an important factor in determining the extent to which an individual has conceptualized the limit. While no significant difference was found in non-experience classes between grades seven and eight, nine and ten, or eleven and twelve in the extent to which they had conceptualized the limit, at each of the three grade levels, seven, nine, and eleven, highly significant gains were made by pupils in the experience classes. Thus, in each case, three hours of special experience actually produced a difference, whereas a year of added maturity did not.

In those instances where non-experience groups had significant differences in Limits Test scores between grade levels, i.e., between grades eight and nine and between grades ten and eleven, examination of the curricula of those schools studied suggested that even these differences may very well have been a consequence of experience.

(2) In each of the experience classes, significant gains were made in the extent to which they had conceptualized the limit. This indicates that pupils at each grade level can conceptualize the limit in mathematics.

(3) The indicated correlation of chronological ages and Limits Test scores for the entire group in the study was extremely low. For a given class it was usually negative.

(4) The computed coefficients between Limits Test scores and mental ages indicated a low to moderate positive correlation between these two variables.

(5) The positive correlation of grade point averages in mathematics classes and Limits Test scores, while not as high as for mental age, was low to moderate.

From these findings it appears that junior-senior high school pupils can conceptualize the limit and that experience is a major factor in determining their proficiency in

this area. This inference is important to present mathematics curriculum and instruction since this concept, though commonly omitted, is fundamental to the presentation of certain topics now taught in the high schools. It is especially important to future curriculum development, organization of textbooks, and preparation of teachers.

Microfilm $2.00; Xerox $5.80. 119 pages.

ESTHETIC PREFERENCE CHANGE AND THE PERSONALITY OF THE STUDENT

(L. C. Card No. Mic 58-5729)

Douglas W. Tatton, Ed.D.
Rutgers University, 1958

This study sought to describe and to quantify the relationships existing between the degree to which an individual's esthetic preference pattern is altered during a curriculum experience designed to effect such change and the temperamental and intellectual characteristics of the individual. A survey of related research disclosed a strong relationship existing between personality type and the type of esthetic preference displayed by the individual. Also noted was a well defined tendency for esthetic preference orders to remain relatively constant over extended periods of time. Studies in suggestibility indicated that change in esthetic preference might well be due to such external factors as the need for group approval or dependence upon the authority of expert opinion. These findings seemed to call for an examination of the dynamics of change in esthetic preference, with special emphasis on the relationship of this change to the personality structure of the individual. Briefly stated, then, the problem examined was (a) does significant change in esthetic preference occur during a long range curriculum experience designed, in part, to effect this change, and, (b) if this change does occur, what limitations are imposed on it by the student's personality and temperamental structure?

The subjects of the study were 122 sophomore level students of the New Jersey State Teachers College at Newark. All subjects were majoring in General Elementary Education or Kindergarten-Primary Education. The group was composed of 11 men and 111 women, all of whom were enrolled in a two semester art course which met for four clock hours per week throughout the entire academic year.

Two principal instruments were used in the study, one a measure of esthetic preference and the other a measure of personality characteristics. A scale, The Preference Inventory, was constructed which would typify the esthetic preferences of the subject in terms of a traditional-modern, or realistic-abstract, continuum. The inventory was an absolute judgment scale applied to materials of several kinds (painting, sculpture, architecture, ceramics, furniture). This inventory was administered both before and after the course of instruction mentioned previously. A quantitative description of the personality of the individual was obtained through the use of the Personality Research Inventory, Form CETX3, a conventional personality inventory which yields scores in 25 distinct personality variables. In addition to the dimensions already listed, each subject was characterized by the A.C.E. Psychological Examination for College Freshmen, a measure of academic ability, and the Point-hour Ratio, a measure of academic achievement consisting of a weighted numerical average of college grades.

An estimate of true change in esthetic preference was obtained for each subject by statistical treatment of the "before" and "after" scores obtained with the Preference Inventory. This estimate of change was correlated (Pearson r) with each of the 25 personality dimensions inventoried as well as both the measure of academic aptitude and of academic achievement. Each of the relationships was tested for statistical significance at the 5% level of confidence.

The findings indicate that, based upon the specific study herein described, significant change in esthetic preference did occur in conjunction with a curriculum program intended, in part, to stimulate such change. The study, however, also documented a tendency for esthetic preference type to remain relatively constant, the conservative and the less-conservative individuals tending to maintain their relative position in the group despite achievement of measurable change by the group as a whole. No statistically significant relationship was found to exist between change in esthetic preference and any of the 25 personality dimensions tested. A statistically significant relationship was observed between esthetic preference change and both intelligence and college achievement, indicating that achievement of change in this respect is not substantially complicated by the personality characteristics of the individual, but is at least partially determined by factors which bear heavily on academic achievement of other more common types.

Microfilm $2.00; Xerox $6.60. 139 pages.

A COMPARATIVE STUDY OF GANDHIJI'S EDUCATIONAL IDEAS AND THE GOVERNMENT OF INDIA'S BASIC EDUCATION PROGRAMS— A STUDY IN VALUES

(L. C. Card No. Mic 59-3725)

Narasimhamurthy Vedavyasa Thirtha, Ph.D.
Stanford University, 1959

Problem: This is a study of the value-orientations of Gandhiji's educational writings and official pronouncements of the Basic Education programs of the Government of India. Its purpose is to identify areas of congruence and conflict between the two sets of values, against a background of rural Indian values, and to draw from these interrelationships some implications concerning the form educational programming in India may take.

Methodology: The cultural values of rural India were regarded, in this study, as the baseline. These values were identified by drawing a consensus from writings by social scientists on rural Indian culture. Valuational units corresponding to this values baseline were identified in Gandhian and governmental systems by applying a method of content analysis to literature describing both systems--speeches and writings by Gandhiji and official publications of the Government of India. Areas of congruence and conflict among these three sets of values--rural India, Gandhian, and governmental--were determined subsequently by using a comparative method.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Findings: Seven dominant rural Indian themes were identified in the literature surveyed. They were: Religious-Spiritual, Pluralism, Hierarchy, Familistic Individualism, Anasakti (Detachment), Dharma (Right Action), and Change and Progress. Each of these themes was found to be composed of several sub-categories (43 total).

The content analysis of a total sample of Gandhiji's educational writings yielded an incidence of 44.5 percent valuational units positively oriented toward rural Indian values, and 4.4 percent units negatively oriented. Content analysis of a representative sample of the educational publications of the Ministry of Education, Government of India, yielded an incidence of 20.5 percent valuational units positively oriented and 7.6 percent units negatively oriented toward rural Indian values.

Both systems of values were found to contain 24 categories of innovated values; 8 categories were common to the two systems; 7 categories were unique to the Gandhian system and 9 categories were unique to the governmental system. The dominant aspects of these innovations were as follows: Categories of Nationalism, Socialism, Democracy, Honest efficient living, and Livelihood were emphasized in both; Rural virtues, Self-sufficiency and Wholistic life based on Non-violence, Bread-labour and Simplicity characterize the Gandhian emphasis; Industrial-technological values based on the Western-oriented system of values characterized the governmental system.

Conclusions: The study indicates that there are differences between the Gandhian and governmental systems of values as evidenced in the literature. The Gandhian system as a whole is oriented more toward Indian rural values than is the governmental system. The governmental Basic Education orientation places comparatively greater value upon industrialization. It may be inferred that the former has the greater potential for bringing about orderly culture change in rural India. This inference is based on the theoretical assumption that social disorganization in culture change is in part a consequence of lack of congruency between traditional and introduced values.

But the problem before Basic Education programs in India is that industrialization is inevitable, and therefore should not be resisted. The forces of industrialization, science, and technology must penetrate the traditional Indian culture, but in such a manner as to bring about a comparatively non-destructive adaptation. The present study brings to light the necessity of discovering a combination of values as a basis for policy and policy implementation in development of educational programs that will make this possible. The interpretation of the "Socialistic Pattern of Society" and emphasis on "Dignity of work," "Cottage industries" and "Respect to Gandhiji" found in governmental thinking, suggest that moves in the direction of a workable combination are underway to some extent.

Suggestions: The study has demonstrated the need of extensive field work to identify the core and peripheral values of rural Indian culture so that Basic Education programs can be implemented more effectively in rural areas in India. Secondly, a genuine synthesis of the Gandhian and governmental value systems in the development of Basic Education programs may be considered desirable for reasons already cited. But where differences between the two systems are basic, they need to be recognized as such without creating ambivalent attitudes in the mind of the teacher involved in the Basic Education program. This can be done in part by the development and dissemination of results of studies such as the present one.

Microfilm $4.40; Xerox $15.20. 355 pages.

CARING FOR THE NEEDS OF MENTALLY GIFTED CHILDREN IN A REGULAR CLASSROOM

(L. C. Card No. Mic 59-3045)

Thomas R. Trahin, Ed.D.
University of Arkansas, 1959

Major Professor: Jennie Lou Milton

Purposes of the Study

The purposes of this study are to ascertain whether the needs of mentally gifted children in the elementary school can be met in a regular classroom where there is an individualized, enriched program and to identify certain practices in the regular classroom of an elementary school that are effective in meeting the needs of mentally-gifted children.

Procedure

A survey of literature was made to determine provisions made for gifted children and an overview of what is being done in the country was received from brochures by eighteen school systems setting forth their current school programs. Information from the literature and brochures was used in finding the better known principles of child growth and development and to determine what is needed for an individualized, enriched curriculum in elementary schools. Also from this information, an observational questionnaire on an individualized, enriched curriculum was prepared and used to select classrooms for observation and study. Other questionnaires were filled out by selected teachers in order to determine whether the philosophy of the teachers concerning mentally-gifted children was in accordance with the better known principles of child growth and development and if they were carrying on an individualized, enriched program. The author then visited the classrooms to see if the teachers were actually putting into practice their philosophy concerning mentally-gifted children.

Mentally-gifted children were located by conferences, observations, intelligence tests, the comparison of intelligence test scores with achievement test results and an analysis of reading achievement. The child's abilities and needs were discovered through an analysis of school records and individual work folders, observations, and sociograms, trait questionnaires, hobby questionnaires and interest inventories filled out by the children.

The actual progress or development of these children was determined by the administration of achievement tests, a comparative analysis of school records and observations, a re-administering and comparing of the sociogram, trait questionnaire, hobby questionnaire and interest inventory and records kept by the teachers of the children's questions, comments, activities, achievements, etc.

Findings from the survey of literature relating to mentally-gifted children were used as an aid in determining whether the progress of an individual child seems to be in harmony with his abilities and stage of development and a careful analysis of observation records, etc. was made to ascertain those practices which seemed most effective in meeting the needs of gifted children in the elementary school.

Findings

According to test results, the mentally-gifted children in all schools showed progress above what is normally expected -- that is, they showed more progress than the other children and more than the average of a year of progress per year. Also, they tended to be far above grade level in all achievements but especially in reading. Many of the gifted children who showed little progress were at the top end of the testing scale and therefore could not show greater improvement.

In the area of personal and social adjustment, in general, the author found that the mentally-gifted children in this study have worthwhile personal and social characteristics and the school curriculum and teacher's philosophy give evidence of being primary reasons for the children having these worthwhile characteristics.

Practices found effective in meeting the needs of mentally-gifted children included a cooperatively planned curriculum in an attractive room with flexible room arrangement. Provision is made for continuous self-evaluation and various means are used to report to parents. The three R's are taught as needed and, especially in reading, there is an individualized, enriched program. In all phases of teaching and learning, provision is made for seeking self-selection and pacing of instruction to fit the stage of development of each child with effort made to place each child where he will be well adjusted and learn best. This total program is based on the idea that all children have gifts that should be developed.

Conclusions

Since the mentally-gifted children in this study showed achievement above what is normally expected, have worthwhile personal and social characteristics and the school curriculum and teacher's philosophy give evidence of being primary reasons for this, the author can but conclude that a good, enriched, self-contained classroom program does take care of the needs of mentally-gifted children in the elementary school.

Microfilm $2.05; Xerox $7.20. 155 pages.

ENGINEERING, GENERAL

DIEMAKING IN THE FOLDING BOX INDUSTRY.

(L. C. Card No. Mic 59-1993)

Richard Virdin Evans, D.Eng.
The Johns Hopkins University, 1959

This dissertation is an account of experiments conducted while the author was the Lord Baltimore Press Fellow in Industrial Engineering at The Johns Hopkins University. The purpose of the experiments was to develop a better method of making the steel rule dies used in cutting and creasing folding boxes.

The present die is composed of steel rules positioned by plywood blocks. The new process substitutes a plaster casting for the plywood blocks. Since the dies are used in gangs of as many as 100 dies, it is necessary to duplicate a model die a number of times. The casting process which was developed permits the accurate duplication of the model.

The plastic dies have many advantages over the present wooden ones. The casting process will permit savings in the die making operation. It also permits improvements in the accuracy of the dies. One consequence of this improvement is a reduction in the time required to make-ready the cutting and creasing presses on which the dies are used.

A step by step outline of the casting process is given with appropriate illustrations. This involves both the construction of an appropriate mold from a model die and the casting of a die from this mold. The equipment required for plastic die making is described. It is estimated that the casting system can be instituted at the Lord Baltimore Press for approximately $20,000 which is the expected annual savings of the new process.

As the system which was developed does not take fullest advantage of the casting method, recommendations for further developmental work are also given. In particular, by making the mold first and then the model die, it will be possible to eliminate the duplication problem entirely.

The final chapter contains a brief discussion of some problems of industrial experimentation as they appeared during the three and a half year course of this study.

Microfilm $2.00; Xerox $6.00. 125 pages.

ENGINEERING, AERONAUTICAL

EXTENDED HYPERSONIC SMALL-DISTURBANCE THEORY.

(L. C. Card No. Mic 59-4358)

George Dewey Waldman, Ph.D.
Brown University, 1959

Hypersonic small-disturbance theory, which treats inviscid high-speed flows over thin bodies, is used in this paper as the first-order solution in a perturbation procedure. This procedure consists of an expansion in the square of a small parameter which is proportional to the thickness ratio of the body. For sufficiently large values of the hypersonic similarity parameter, which is the product of the free-stream Mach number and the thickness ratio of the body, the second-order solution in this perturbation allows the computation of the flow fields past somewhat thicker bodies and at somewhat lower speeds than are covered by the first-order small-disturbance theory.

In this paper is shown the method for finding the second-order small-disturbance solution for two-dimensional and axisymmetric flows. The application of the theory is illustrated by a few simple examples -- the wedge, the cone, and the flow field in the neighborhood of the nose of a two-dimensional or axisymmetric ogive. A discussion is given of "direct" and "inverse" methods of solution: the former uses the unknown tangent of the second-order shock angle as the expansion parameter, while the latter uses the known tangent of the shock angle given by the first-order theory. The latter method is adopted for convenience.

As a special case of "hypersonic strip theory", which is closely related to hypersonic small-disturbance theory, the first-order theory for high-speed flows past flat, planar conical bodies is investigated. A singularity in such flows is found. This singularity is located in the plane which passes through the nose and which is parallel to the free-stream direction and perpendicular to the mean surface of the body. A description of the probable behavior of the flow in the neighborhood of this singularity is given.

The form which the first- and second-order theories may be expected to take for an arbitrary thin or slender body is presented in terms of a suitably defined orthogonal coordinate system.

Microfilm $2.00; Xerox $3.80. 66 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

ENGINEERING, CHEMICAL

DEVELOPMENT OF VACUUM-COMPRESSION FRACTIONATION COLUMN.

(L. C. Card No. Mic 59-3617)

Robert D. Beattie, D.Ch.E.
Polytechnic Institute of Brooklyn, 1959

Adviser: Dr. Donald F. Othmer

Satisfactory equipment is lacking for industrial vacuum distillations of heat sensitive materials from the molecular range to 30 mm Hg Abs. Because low pressure drop in the column is important, a contacting unit was conceived with a slight compressing effect to overcome friction losses.

To evaluate stages with vapor compressing a design was selected using a Nash impeller with a system for spraying reflux liquid countercurrent to the vapor stream. Experiments studied vapor and liquid flow and contacting to determine the best design and discharge diffuser for changing the direction of vapors with minimum friction loss. Stages with helical vanes handled more vapor at no apparent pressure drop than stages without vanes or with cylindrical or flat stator vanes. Six equally spaced helical vanes generated at a 10^0 angle is the optimum stator (capacity: 53 CFM air at $\Delta P = 0$, 1 atm., 1000 RPM impeller speed, and 54.5 lb./hr.-ft.^{2} water rate).

Having a representative stage design, three types of mass transfer studies were made: absorption, vacuum rectification, and atmospheric rectification (with different test systems).

Absorption tests used the acetone-air-water system with one stage at atmospheric pressure for impeller rotation rates, W, between 300 and 1550 RPM. Liquor rates, L, were between 80 and 165 lb./hr.-ft.^{2}, and gas rates, G, between 103 and 208 lb./hr.-ft.^{2} Increased G, L, and W caused improvement in mass transfer coefficient, $K_G a$, other variables being held constant. Absorption Murphree efficiencies, between the same gas and liquor rates, increase with L and decrease slightly with increased G, although W produced the largest effect. The following equation for over-all $K_G a$ correlates the data with G, L, and W within 5%.

$$\frac{1}{K_G a} = \frac{8.26 + 7.45 \times 10^{-3} W - 6.55 \times 10^{-6} W^2}{G^{0.8}} + \frac{468 - 0.625W + 3.0 \times 10^{-6} W^2}{H\, L^{1.35}}$$

Prior to distillation studies, physical properties and vapor-liquid equilibria were determined for the systems: n-butyl ether-dichloroethyl ether (hereinafter called the ether system) at 20, 30, and 50 mm Hg Abs. and for chloroform-benzene at 1 atm. Rectification tests were performed using a 3 stage column with appropriate auxiliary equipment for sub-atmospheric operation. Murphree efficiencies, pressure losses, and power consumption were observed with rotation rate (300 to 1550 RPM), pressure (20, 30 & 50 mm Hg Abs.), superficial vapor velocity (1 to 10 ft./sec.) and liquor rate, using the ether system. Similar data were observed at atmospheric pressure, using chloroform-benzene.

Graphical exploration of variables showed that E_{MV} increases with W between 300 and 1600 RPM for constant pressures of 20.2, 30.0, and 50.1 mm Hg Abs. and for equal G and L from 0.61 to 3.24 lb. moles/hr.-ft.^{2}, using the ether system. Similar increases in E_{MV} with W occur at atmospheric pressure and total reflux using the chloroform-benzene system. Studies at 1000 RPM and 30 mm Hg Abs. using the ether system showed that, at constant L, efficiencies observe a maximum with G, but at constant G, L has little effect on E_{MV}. These effects are confirmed by correlation with reflux ratio. For constant gas rates using the ether system at total reflux below 2.08 lb.moles/hr.-ft.^{2}, efficiencies decrease with pressure between 50 and 20 mm Hg Abs. The superficial vapor velocity at no apparent pressure loss, u_o, increases with rotation rate, and W correlates linearly with $\frac{u_o P}{T}$ in $\frac{\text{m.m.-ft.}}{\text{sec.-}^0\text{R}}$ on log paper. Power consumed in rotating impellers increases exponentially with rotation rate, and power increments consumed by liquid pumping and by vapor compression plus liquid spraying increase linearly with W on log paper.

Based on results for: E_{MV}, u_o, and power consumption, studied with respect to several variables (pressure, systems, rotation rate, gas and liquor rates), it is concluded that vacuum-compression fractionators can be used successfully to separate heat sensitive materials where higher pot pressure than head pressure formerly has been a restriction. Efficiencies are higher than available with conventional bubble cap or packed columns, and power consumed is negligible.

Patent protection is being secured on this invention.

Microfilm $6.55; Xerox $22.60. 515 pages.

THE CONSTANT VOLUME HEAT CAPACITIES OF GASEOUS PERFLUOROCYCLOBUTANE AND PROPYLENE.

(L. C. Card No. Mic 59-3921)

Noel Howard de Nevers, Ph.D.
University of Michigan, 1959

The constant volume heat capacity, C_v, is an important thermodynamic property, both technically and theoretically. The purpose of this research was to determine C_v of perfluorocyclobutane and propylene over as wide a range of temperatures and densities as possible in one calorimeter, and to compare the experimental values of C_v with those calculated from equations of state and the values of the zero-pressure constant volume heat capacity, C_v^*.

To measure C_v, a new type of calorimeter was constructed. It was an adiabatic calorimeter, designed to have the highest possible ratio of heat capacity of contents to heat capacity of calorimeter. The calorimeter differed from previous C_v calorimeters by being very thin-walled, and by containing an internal stirrer to equalize surface temperatures, which most previous C_v calorimeters did not contain.

The C_v of perfluorocyclobutane was found to vary from 0.2164 to 0.2594 cal/gm ^{0}C in the temperature range 101

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to 147°C and the density range 0.1569 to 0.5366 gm/cc. The C_v of propylene was found to vary from 0.3903 to 0.4991 cal/gm°C in the temperature range from 67 to 146°C and the density range from 0.04814 to 0.1609 gm/cc.

For temperatures close to the critical temperature and densities greater than 1/2 of the critical density, C_v increases very rapidly with decreasing temperature. This behavior has not been shown by interpretations of state data, presumably because of the imprecision of state data in this region. For equal reduced temperatures and reduced densities, the value of $C_v - C_v^*$ on a molar basis for perfluorocyclobutane was 1.6 to 2 times that for propylene.

The experimental results have been compared with the predictions of the Martin-Hou, Beattie-Bridgeman, and Benedict-Webb-Rubin equations of state. In general, the agreement between the measured C_v and that calculated from C_v^* and the above equations is satisfactory; the maximum difference is 6.7% of the experimental value. However, the comparison does reveal the following systematic differences:

a. At low densities the experimental second derivative of C_v with respect to density at constant temperature, $(\frac{d^2C_v}{d\rho^2})_T$, is positive; that predicted by the Beattie-Bridgeman equation is also positive, while that predicted by the Martin-Hou and Benedict-Webb-Rubin equations is negative. The experimental results show that $(\frac{d^2C_v}{d\rho^2})_T$ is zero or very small for all temperatures over the density range from 1/4 to 1/2 of the critical density; the Beattie-Bridgeman equation predicts that it is zero at some point in this region, while the Martin-Hou and Benedict-Webb-Rubin equations predict that it is negative throughout this region.

b. The experimental results show that for densities greater than 1/2 of the critical density $(\frac{d^2C_v}{d\rho^2})_T$ is positive for temperatures very near to the critical temperature, and that it decreases with increasing temperature, becoming negative for temperatures more than 20°C above the critical temperature. All three equations of state predict that at a given density, $(\frac{d^2C_v}{d\rho^2})_T$ has the same sign for all temperatures, and that near the critical density it is negative.

c. At high densities none of the above equations of state predicts the relation of C_v to temperature accurately; the Martin-Hou equation predicts a better approximation of this relation than does the Beattie-Bridgeman equation or the Benedict-Webb-Rubin equation.

Microfilm $2.20; Xerox $7.60. 165 pages.

KINETICS OF THE LIQUID-PHASE ADDITION REACTIONS INITIATED BY PROPYLENE OXIDE AND METHANOL AND CATALYZED BY SODIUM HYDROXIDE.

(L. C. Card No. Mic 59-3933)

Manchiu Duke S. Lay, Ph.D.
University of Michigan, 1959

The purpose of this investigation was to study the kinetics of the series of consecutive, competitive and irreversible chemical reactions initiated by the reaction of methanol with propylene oxide and catalyzed by sodium hydroxide.

The experimental work was performed in a glass batch reactor and was divided into the following categories:

1. Velocity of the Individual Reactions

The effects of temperature and catalyst concentration on the rates of the reaction of propylene oxide with methanol; propylene oxide with dipropylene glycol methyl ether; and propylene oxide with tripropylene glycol methyl ether were determined over a temperature range of 35°C to 100°C and for sodium hydroxide concentrations of 0.0556 to 0.3495 moles/liter. Initial mole ratios of alcohol to oxide of 5 to 45 were used.

The rate equation obtained was a second order rate equation

$$\frac{dC_{AB_n}}{dt} = \underline{k}_n C_{AB_n} C_B$$

The rate constants of the individual reactions were shown to be linear functions of the catalyst concentration, and their temperature dependence followed the Arrhenius equation.

The equations for the rate constant of each of the individual reactions were:

1. Propylene oxide-methanol reaction:
$$\underline{k}_1 = 1.02(10^9)e^{\frac{-17,200}{RT}} \text{ moles}^{-2}\text{lit}^2\text{min}^{-1}$$
2. Propylene oxide-propylene glycol methyl ether reaction:
$$\underline{k}_2 = 0.97(10^5)e^{\frac{-11,700}{RT}} \text{ moles}^{-2}\text{lit}^2\text{min}^{-1}$$
3. Propylene oxide-dipropylene glycol methyl ether reaction:
$$\underline{k}_3 = 4.75\ (10^7)e^{\frac{-15,800}{RT}} \text{ moles}^{-2}\text{lit}^2\text{min}^{-1}$$
4. Propylene oxide-tripropylene glycol methyl ether reaction:
$$\underline{k}_4 = 2.25\ (10^9)e^{\frac{-18,500}{RT}} \text{ moles}^{-2}\text{lit}^2\text{min}^{-1}$$

2. Product Distributions

The distribution of products was obtained for the system of consecutive reactions initiated by propylene oxide and methanol at 45°C over the initial alcohol to oxide mole ratio of 0.645 - 10 and for the system of consecutive reactions initiated by propylene oxide and propylene glycol methyl ether at 60°C over the initial glycol to oxide mole ratio of 0.665 - 3. It was found that the experimental

product distribution data can be reproduced by the use of the second order rate equation and the individual rate constants when methanol is not present in the reaction mixture. In the presence of methanol the individual rate constants fail to reproduce the experimental product distribution data.

3. Effect of Composition Change

The effect of methanol concentration on the velocity of reaction of the propylene oxide - methanol and the propylene oxide - propylene glycol methyl ether reaction was investigated at 45°C. It was shown that a modification of the individual rate constants to account for the effect of methanol composition could be made as follows:

$$k_1 = \underline{k}_1 \, e^{1.42(1-C_A/M)}$$

$$k_n = \underline{k}_n \, e^{-2.4(C_A/M)} \quad \text{for } n \geq 2$$

where

C_A = Concentration of methanol at time t, moles per liter.

C_{AB_n} = Concentration of alcohol-ether at any time t, moles per liter. ($AB_n = A$, for $n = 0$).

$\underline{k}_n$ = Second order rate constants, $moles^{-2}lit^2min^{-1}$.

C_B = Concentration of propylene oxide at any time t, moles per liter.

M = Reciprocal of the molar volume of methanol at the temperature of the reaction, moles per liter.

R = Gas constant, 1.987 calories per mole per degree Kelvin.

T = Absolute temperature, degrees Kelvin.

The resulting rate constants were able to correlate product distribution data initiated by the reaction of methanol with propylene oxide.

Microfilm $2.00; Xerox $6.60. 137 pages.

PLATE EFFICIENCIES AND MASS TRANSFER FOR VALVE TRAYS AND TRAYS WITH LARGE PERFORATIONS.

(L. C. Card No. Mic 59-3944)

Robert Henry Miller, Ph.D.
University of Michigan, 1959

Performance data were obtained for a valve and a perforated tray and compared with data on bubble-cap trays. Two systems were used in which the resistance to mass transfer is in the vapor phase.

The valve tray contained nine 7/8-inch holes fitted with 1-1/2-inch valves stamped from 18 gauge sheet and located on a 2-1/2-inch square pitch. The perforated tray was identical to the valve tray except that the valves were removed. The trays were installed in the column previously used for bubble-cap studies by the Tray Efficiency Program of the American Institute of Chemical Engineers. The tray was 7-1/2 inches wide and 13 inches long from inlet downcomer to outlet weir. A splash baffle was installed upstream from the weir to smooth the liquid flow and to confine the bubbling action.

The ranges of operating conditions were:

System	Liquid Rate	Gas Rate	Weir Height
Air Humidification	8, 16, 24 gpm	1 - 5 ft/sec	1-1/2, 3-1/2 in
Ammonia Absorption	8, 16, 24, 32 gpm	1 - 5 ft/sec	2, 3-1/2 in

The data recorded were composition of the gas and liquid streams entering and leaving the tray, froth and clear liquid heights, pressure drop through the tray, and composition profiles for the ammonia absorption system. From the data, the mass transfer was calculated in terms of tray efficiency and transfer units.

Mass Transfer - It was found that the Murphree plate efficiency for both systems investigated increases with either an increase of weir height or an increase of liquid rate. At a weir height of 3-1/2 inches, the efficiency in the stable operating range was almost independent of vapor rate. At weir heights of 1-1/2 and 2 inches, the efficiency decreased as the vapor rate was increased. For humidification a minimum value was obtained at vapor velocities of from 2 to 3 feet per second followed by an increase in efficiency as the vapor rate was further increased.

The mass transfer data, as expressed in transfer units, were correlated by the following equations:

Humidification, Valve Tray

$$N_G = 5.84(Z_f - Z_c)^{0.475} \, u^{-0.382} \, Z_w^{0.183}$$

Ammonia Absorption, Valve Tray

$$N_G = 4.97(Z_f - Z_c)^{0.621} \, u^{-0.458} \, Z_w^{0.287}$$

Ammonia Absorption, Perforated Tray

$$N_G = 3.72(Z_f - Z_c)^{0.650} \, u^{-0.459} \, Z_w^{0.407}$$

where N_G is the number of individual gas phase transfer units; Z_f is the froth height, feet; Z_c is the clear liquid height, feet; u is the gas velocity based on the active bubbling area, feet per second; and Z_w is the height of the overflow weir, inches. The inclusion of weir height as an independent variable improved the correlation over that obtained using the same form but with weir height omitted.

Performance of the valve and perforated trays can be estimated from existing correlations for bubble-cap trays. These estimates can be improved by use of correction factors for N_G that were determined and found to be a function of tray design and weir height. The values obtained ranged from 0.85 to 1.0 for the valve tray and from 0.7 to 0.9 for the perforated tray.

Fluid Dynamic Behavior - The clear liquid height was essentially constant for a given weir height and liquid rate; the froth height showed a linear increase with vapor rate. The froth density was a function primarily of vapor rate and did not vary significantly with weir height, liquid rate, or tray design. The weeping, or leakage, through the perforated tray was found to be primarily a function of the vapor velocity through the holes, being negligible for hole velocities greater than 32-38 feet per second. Liquid mixing, as described by the recycle concept, was greater for the perforated tray than for the valve tray, but in each case was not as large as that previously found

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for bubble-cap trays. The entrainment was greater for the perforated tray than for the valve tray.

Microfilm $2.65; Xerox $9.20. 202 pages.

AN INVESTIGATION OF THERMAL PARAMETERS FOR A PACKED BED SYSTEM.

(L. C. Card No. Mic 59-3881)

Donald F. Molino, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: William W. Shuster

In order to be able to improve the design and to more rigorously calculate the desired operating conditions required of catalytic reactors, an increase in the knowledge of the thermal data for this type of system is required. The behavior of overall thermal conductivities and wall film coefficients as a function of easily measurable parameters, and the distribution of conductivities and temperatures throughout the reactor are among the quantities that are considered important.

Therefore, to gain some insight into the problem of packed bed heat transfer, a series of experiments were performed to obtain temperature profiles associated with packed beds. These experiments consisted of passing pre-heated air through stationary beds packed with Celite cylinders and measuring the effluent air temperature profiles. The resulting temperature profiles formed the basis for subsequent analytical calculations.

Analysis of these data in terms of the many individual mechanisms available for both heat and mass transfer within such systems would be very difficult and complicated. Consequently, the equations required for the calculations were derived, and the resulting experimental data analyzed, by considering conduction as the sole means of transfer within the bed. Three analytical methods were employed to calculate the results. Overall bed average quantities were obtained from the first method. The second method yielded axially averaged radial dependent values. Local radial position dependent results were calculated with the third method of analysis. The results, related to all the mechanisms present, were interpreted in terms of effective thermal conductivities and wall film coefficients.

For this investigation, only one tube size, 8" I.D., was studied in conjunction with three sizes of Celite cylinders (3/8" x 1/2", 1/4", 1/4" x 1/8" x 1/8") as the packing material. Packing depths ranged from 6" to 24" in 6" intervals. Mass flow rates of air, based on the empty container, varied from 110 to 450 lbs./hr.ft.^{2} Steam served as the heating medium.

Development of a generalized correlation for the overall effective thermal conductivity of a packed bed yielded

$$k_{e_c} = 0.1 + .089 \left[\frac{D_c}{Z}\right]^{.44} \left[\frac{\sqrt{a_p} G}{\mu_m}\right]^{.32}$$

with a standard error of estimate of $\pm$ 0.084. Values of the overall effective thermal conductivity calculated from the observed data varied from 0.20 to 0.90 Btu/hr.ft.^{2} $^\circ$F/ft. for the range of variables studied. Also calculated were values for axially averaged effective conductivities and local point effective conductivities as a function of radial position.

Wall film coefficients, calculated from an average temperature difference driving force, ranged from 2 - 18 Btu/hr.ft.^{2} $^\circ$F. A standard error of estimate of $\pm$ 0.586 was calculated for the following correlation:

$$h_{w_c} = .705 \left[\frac{\sqrt{a_p}}{D_c}\right]^{.13} \left[\frac{D_c}{Z}\right]^{.64} G^{.61}$$

Microfilm $2.00; Xerox $5.20. 102 pages.

PARTIAL OXIDATION OF N-BUTANE.

(L. C. Card No. Mic 59-1994)

Joseph F. Skrivan, D. Eng.
The Johns Hopkins University, 1959

The problem of the initiation mechanism in the oxidation of hydrocarbons, an important phase of many flame systems, remains largely unsolved. This thesis reports a study of the oxidation of normal butane under such conditions that information on the homogeneous initiation reaction has been obtained.

The experimental work was performed in a stainless steel flow reactor designed to provide a sharply delineated reaction zone and to minimize surface complications. Kinetic data was obtained on the reaction between butane and pure oxygen in the temperature range 275-350°C., and at contact times of 0.5 to 10 seconds, on two levels of initial fuel/oxygen ratio. A statistical design was used to minimize the effects of random experimental errors. A total of forty runs were made.

A gas chromatography unit was designed and built especially for use in this research. Five chromatographic columns were required for identification and quantitative analysis of the products and were supplemented by several chemical analyses. Among the twenty-six products identified, the major useful compounds were formaldehyde, methanol, butene, ethylene, and propylene. Water, carbon monoxide, and carbon dioxide were, of course, found in high yield. Butane conversions as high as 35% were observed. In several of the runs periodic cool-flame formation was noted.

In order to postulate a set of initiation reactions which would lead to a rate equation which could be tested against the experimental data, some information concerning the energetics of the reaction was required. Starting with the rate equation for a flow reactor,

$$r\,dv = F\,dx_A$$

the following equation may be developed:

$$\ln \tau = \ln \left[\frac{\rho}{A} \int_0^{X_A} \frac{dx_A}{\prod_i C_i^{\,j}}\right] + \frac{E}{RT}$$

where

r = rate of reaction

V = volume of reacting system

F = feed rate

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X_A = moles A converted per unit mass of feed

τ = contact time

ρ = density

A = Arrhenius frequency factor

$\overset{i}{\pi} C_i^j$ = product of all molecular concentrations upon which the rate depends, raised to the appropriate power

E = activation energy

R = gas constant

T = absolute temperature

Since butane was always present in excess, oxygen is the limiting reactant, and, to a first approximation will be the major term in $\overset{i}{\pi} C_i^j$. At constant oxygen concentration, the log term will be essentially constant, and a plot of ln τ vs. 1/T should yield an activation energy. Activation energies between 7.7 and 10.3 kcal/mole were determined.

With a knowledge of the approximate activation energy, some statements can be made regarding the nature of the controlling step. Overall activation energies of the order of 10 kcal/mole could indicate either a diffusion controlled step or a low energy gas phase or wall activation. Experiments in a packed reactor having shown the reaction to be surface inhibited, diffusion or activation involving the wall could play no part in the activation process. This leaves the possibility of a low energy gas phase bond activation step, involving either O_2/C_4H_{10}, O_2/O_2, or C_4H_{10}/C_4H_{10} collisions.

Further consideration of each of these possibilities led to the conclusion that O_2/O_2 collisional activation was controlling, leading to the rate equation

$$\frac{dc_B}{dt} = -kC_{O_2}^2$$

The validity of the above expression was tested in several ways. The second order oxygen dependence was confirmed by plotting ln (rate) vs. ln C_{O_2}. The slope was found to be 2.2, in sharp agreement with the rate equation. The equation was next tested for constancy of the specific rate constant. To satisfy the rate equation, plots of rate of butane conversion vs. $C_{O_2}^2$ must be linear and pass through the origin. This method again confirmed the rate equation, and the activation energies obtained from this data were in agreement with those estimated by the technique discussed above.

Microfilm $2.00; Xerox $5.40. 119 pages.

TRANSIENT CHARACTERISTICS OF CONTINUOUS EXTRACTION WITH AGITATION.

(L. C. Card No. Mic 59-3637)

H. Kenneth Staffin, D.Ch.E.
Polytechnic Institute of Brooklyn, 1959

Adviser: Dr. J. C. Chu

With greater emphasis on automatic control of chemical processing, there has been an enormous increase in the need for greater understanding of the control characteristics of unit operations. Transient analysis techniques, offer to the chemical industry a valuable potential tool in obtaining this information. Unfortunately, there is very limited available information concerning the transient behavior of the various unit operations. The purpose of this investigation is to provide information regarding the transient characteristics of continuous extraction with agitation and to suggest a general approach toward developing transient characteristic data.

An agitated extractor was set up and operated as a continuous unit on eight chemical systems. The unit was run under steady state conditions and then disturbed with a sudden concentration change in one of the feed streams. The response of the process to the change in concentration was followed. The effect of agitator speed, impeller diameter, and tank diameter on the response characteristics of the system was explored.

Mathematical techniques were employed to use the transient data to approximate the unit step and unit impulse functions. These functions were characterized by a quantity termed, "rise time", which was defined as the time required for the unit step function response to increase from a value of 0.1 to a value of 0.9.

The residence time distribution function for a completely mixed vessel was considered to develop more general functions describing the transient behavior of the system. The general function for the unit impulse response characterized by "rise time", was correlated by a single equation for forty experimental runs. The maximum deviation from this empirical correlation was 10%. The precision of the "rise time" data is estimated as $\pm 7\%$.

The "rise time" data was correlated to the physical and mechanical properties of the system. The equation for the correlation follows:

Organic Phase

$$\left(\frac{2.20\,Dx}{a\,T_{r_o}\,D_o}\right)\left(\frac{\mu_o}{\rho_o D_o}\right)^{-1/2} = 0.373 \times 10^{-3}\left(\frac{D^2N\rho_o}{\mu_o}\right)^{0.97}$$

Aqueous Phase

$$\left(\frac{2.20\,Dx}{a\,T_{r_a}\,D_a}\right)\left(\frac{\rho_o}{\rho_a}\right)\left(\frac{\mu_a}{\rho_a D_a}\right)^{-1/2} = 0.760 \times 10^{-7}\left(\frac{D^2N\rho_a}{\mu_a}\right)^{1.9}$$

The precision of the correlation of the experimental data by these equations was approximately $\pm 18\%$.

The correlation permits a prediction of "rise time" values for a completely mixed agitated extractor from the physical and mechanical properties of the system. The "rise time" values can be converted to transient response functions by the method presented in this investigation. An example application of this technique is given.

Microfilm $4.05; Xerox $13.60. 314 pages.

THERMODYNAMIC CORRELATION OF VAPOR LIQUID EQUILIBRIA.

(L. C. Card No. Mic 59-3640)

David Zudkevitch, D.Ch.E.
Polytechnic Institute of Brooklyn, 1959

Adviser: Donald F. Othmer

(CORRELATION AND PREDICTION OF BINARY MIXTURES)

A new method of correlating and predicting vapor liquid equilibria data of binary systems has been presented. This new method uses a modified form of the equation which has been proposed by Gilmont (112) to correlate relative volatility. The method of predicting vapor liquid equilibria is made from the physical properties of the pure components, which includes latent heats and parachors in terms of field factors that account for the entropy of mixing. The development of this method consisted of three phases:

1. The development of an objective statistical method of determining the parameters of the Gilmont Equation, which correlates each binary system and automatically gives agreement with the Gibbs Duhem Equation.
2. The development of a method of reducing the two parameters of the Gilmont Equation to a corresponding set of field factors, representing the behavior of one component in the force field of the other component. These field factors may be readily determined from the physical properties of the components of the binary mixture.
3. A procedure for selecting the field factors based upon groupings of the components. Then, by reversing the correlation procedure, the Gilmont parameters are calculated from the selected field factors and physical properties of the pure components. From the Gilmont parameters the complete vapor-liquid equilibria for the binary system can be predicted.

Phase 1

Since the experimental error in the determination of the activity coefficient of one of the components in the mixture is known to increase with decrease in its concentration, a statistical method of correlation has been derived which requires the use of a weighting factor. This weighting factor was calculated on the assumption that the experimental error in the determination of composition is a constant absolute value for a given binary system. This assumption is generally true. Any deviation which may occur in this assumption will usually appear in the dilute region where the weighting factor is normally quite small and therefore will have negligible effect.

Preliminary work has proved that two parameters are sufficient for the correlation of most binary mixture systems by the Gilmont equation. This two-parameter equation has been combined with the criterion for thermodynamic consistency to yield an equation which agrees with the Gibbs Duhem Equation.

Experimental data listed in the literature were correlated by this method, which determined the best two parameters of the simplified form of the Gilmont equation for each binary system in accordance with the method of weighted least squares. At the same time the standard deviation for each of these parameters was also determined by the use of Gaussian multipliers. Thus, not only were the parameters obtained by an objective analytical method considering proper weighting factors, but the statistical confidence in these parameters was also obtained.

The actual computations were performed by an IBM electronic computer of the Type 704, which followed the instructions in several separate programs. The correlation of approximately 500 constant temperature and constant pressure binary systems according to the above method yielded a large set of objective data which could be used as a basis for further analysis and prediction of binary vapor liquid equilibria.

Phase 2

In order to predict the two parameters of the Gilmont Equation for a binary system it was decided first to reduce these parameters into a form such that a minimum amount of information about the binary components would be used. The goal of this method is to be able to make this prediction from physical data of the pure components only. The method which appeared most promising was that of Erdos (92) which in turn is based upon the classical work of Hildebrand (146) and Scatchard (294). This method requires a knowledge of the latent heat of vaporization and parachors for each components. The recognized limitations of the Erdos method are:

1. Assumption of zero entropy of mixing;
2. Deviations from Raoult's law may only be positive;
3. Assumption of interaction term to be the geometrical mean of the two energy terms for the pure components.

The Erdos method was therefore modified by making use of the extended Kirejev assumption of proportionality between the Gilmont free energy parameters and the corresponding enthalpy parameters. Field factors were assigned to accommodate for this assumption. In this way the limitations of the other methods were removed; and a set of field factors were calculated for each system.

As a side project of Phase 2, a method has been developed to correlate latent heats with temperature. This method, which is simple and accurate, is a modified form of the Othmer reference substance vapor pressure plots (242).

Phase 3

Exhaustive studies of the results of the above correlation in the 500 systems led to the conclusion that prediction could not be made strictly from the data of the pure components. A compromise is made in which the field factors were selected on the basis of grouping the pure components. It was possible to select a minimum of ten groups in order to classify all possible systems. From the 500 systems it was possible to calculate approximately three-quarters of the possible combinations of these ten groups for quantitative predictions. For those systems which fall into groups where the field factors are lacking, it is still possible to obtain a fairly good estimation of the vapor-liquid equilibria by assuming the value of unity for each field factor.

This grouping of compounds according to their hydrogen bonding paves the way to further developments which may include more physical properties and thus may

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

result in prediction methods that will use the physical properties more directly.

Microfilm $4.70; Xerox $15.80. 367 pages.

ENGINEERING, CIVIL

INTERACTION DIAGRAMS FOR DYNAMIC LOADING IN SUSPENSION BRIDGE DESIGN.

(L. C. Card No. Mic 59-3885)

Charles H. Schilling, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: Professor H. A. Miklofsky

The objective of this study is to develop a direct design procedure for the design of suspension bridges considering the aerodynamic effects, which will insure a structure that is aerodynamically stable; a method that can be accomplished with a reduction in the trial and error procedures and one that will provide a means of direct visualization of the aerodynamic problem expressed in terms of the normal variables and elements associated with structural design. The method is to be developed by an extension of the interaction diagram procedure published by Dr. H. A. Miklofsky in 1955 and is to be based on the "Mathematical Theory of Vibrations in Suspension Bridges" by Bleich, McCullough, Rosecrans, and Vincent. The digital computer will be applied which fact requires the development of the necessary digital computer programs.

The study includes a review of the derivations of the basic equations from Bleich for completeness as well as to define the limitations of and the assumptions involved in the theory. Structural damping, the vortex effect, and the torsional rigidity of towers are neglected. The basic equations, derived by energy methods, are modified to fit the three interaction conditions; namely, where both truss and cable participate in the conversion of kinetic to potential energy, where the cable only participates, and where the truss only participates. Digital computer programs are then developed to determine the critical wind velocity for various values of depth of truss, as well as a variation in truss chord area of $\frac{1}{2}$ and $\frac{1}{4}$ the original values.

The results obtained show that a direct graphical visualization of the effect of a change in truss depth and chord area is obtained and that the critical velocity has a maximum value for a certain depth of truss. They also show that the interaction diagram method cannot be extended to the aerodynamic problem directly due to the absence of the single identifiable point, and key to the interaction procedure of Dr. Miklofsky, which establishes the scale for the entire diagram. It is further seen that the effect on critical wind velocity is an erratic one where, for some values of depth of truss, an increase in chord area produces a smaller critical velocity, while for other values of truss depth, the critical velocity is increased. Such erratic behavior emphasizes the importance for the designer to have the complete picture rather than a few isolated points to prevent errors from extrapolation or interpolation.

The computer programs developed as an adjunct, are completely flexible and permit the designer to study the entire problem or any of its components in any degree of detail desired. Thus a rapid and economical procedure is attainable. The method, using these programs, considers the case of a bridge with unloaded backstays, symmetric modes; and a bridge with loaded backstays for symmetric and asymmetric modes. The Tacoma Narrows Bridge is used as a vehicle of discussion. The Mackinac Straits Bridge is included as an example.

Microfilm $2.75; Xerox $9.40. 209 pages.

ENGINEERING, ELECTRICAL

AN INVESTIGATION OF ADIABATIC RAPID PASSAGE IN IONIC PARAMAGNETS FOR USE IN SOLID STATE MASERS.

(L. C. Card No. Mic 59-3679)

William Walter Anderson, Ph.D.
Stanford University, 1959

Adiabatic rapid passage is a method of inverting the energy level populations in a quantum system. The resulting inverted population may then be used for maser amplification or oscillation. The theory of adiabatic rapid passage and the first applications were used in the study of nuclear magnetic moments. This study extends the results to electron spin resonance systems with emphasis on ionic paramagnets.

The theory of adiabatic rapid passage is shown to apply to any two-level quantum system under the appropriate conditions. Interactions with other quantum levels and interactions not taken account of in the simple theory developed are then described by phenomenological relaxation times. It is shown that the only significant relaxation time in adiabatic rapid passage experiments is the spin-lattice relaxation time.

Several types of masers are discussed. Gain and bandwidth calculations are given for a general two-level regenerative maser. The effect of inhomogeneous broadening is shown to give a larger bandwidth at a given gain than is obtainable from a maser amplifier operating on a homogeneously broadened line. Two specific maser schemes discussed are the rotating-field continuously operating maser and the double-inversion maser. The latter has the interesting property of a pump or inverting signal at only half the signal frequency.

The possibility of adiabatic rapid passage inversion of energy level populations is experimentally verified in potassium chromicyanide isomorphically diluted with diamagnetic potassium cobalticyanide, and in pink ruby. Maser oscillations were observed in both materials. The spin-lattice relaxation time in $K_3Cr(CN)_6$ is estimated to be in the tens of milliseconds while that of ruby is in the units of milliseconds. A double spin inversion was performed in ruby, giving a population inversion over three energy levels. When two magnetic resonances were nearly degenerate in ruby, the spin-lattice relaxation time was shortened to a few hundred microseconds or

less. The implications of this in two-level and three-level maser operation are discussed.

Microfilm $2.30; Xerox $8.00. 172 pages.

ON ADAPTIVE CONTROL SYSTEMS.

(L. C. Card No. Mic 59-3620)

Ludwig Braun, Jr., D.E.E.
Polytechnic Institute of Brooklyn, 1959

Adviser: Dr. John G. Truxal

The high level of sophistication which exists in modern technological systems, such as industrial processes and military weapons systems, places severe performance requirements on the controllers employed in these systems. Frequently the process characteristics are imperfectly known, or vary markedly with time, in an unpredictable way. It has become increasingly difficult to design control systems to operate satisfactorily under these circumstances, using conventional feedback control theory. Much effort has been expended in recent years to develop new techniques for designing control systems to meet these stringent requirements. One result of this effort is the adaptive control system, which is a control system which adapts its controlling action to the present dynamic behavior of the process and the presently required performance. The purpose of this investigation is to consider methods of realizing control systems which exhibit adaptation.

Before the design of adaptive control systems may be undertaken, a basic philosophy for such systems must be developed. In the present dissertation, a philosophy is developed by briefly considering the behavior of a human being acting as a controller in situations which require adaptation. It is observed that the human being performs essentially two tasks in carrying out his adaptation. The first of these tasks is to obtain some knowledge of the process dynamics by making measurements of the process excitation and response. This aspect of the overall adaptation is called the Identification Problem. The other task is the determination of the excitation required to achieve a desirable performance. This is called the Excitation Problem. The adaptive control system is, then, simply a mechanization of the solutions of the Identification and Excitation Problems.

The specific techniques for solving the Identification Problem are described. The Maclaurin series expansion of the impulse response is used as a means of identifying the process dynamics. Representation of the impulse response as the sum of a set of pre-selected exponential functions with coefficients chosen to obtain a good fit to the process dynamics is considered as a means of solving the Identification Problem. Finally, the impulse response is expanded in a series of orthonormal functions. A solution of the Excitation Problem which is appropriate to each of these solutions of the Identification Problem is described.

Each of the specific implementations of the basic philosophy employs techniques which are well within the capabilities of present-day computer techniques. As a result of this, it is seen that adaptive control systems are realizable and may be employed wherever they are applicable. Microfilm $2.00; Xerox $4.80. 93 pages.

ON THE DISCONTINUITY PROBLEM AT THE INPUT TO AN ANISOTROPIC WAVEGUIDE.

(L. C. Card No. Mic 59-3621)

Aaron David Bresler, D.E.E.
Polytechnic Institute of Brooklyn, 1959

Adviser: Professor N. Marcuvitz

Variational solutions are obtained for the scattering coefficients at the junction of two dissipationless uniform waveguides, one of which is anisotropic. These solutions are then employed to obtain numerical results for the junction of two rectangular waveguides, one empty, the other filled with a transversely magnetized dissipationless ferrite. These numerical results are found to agree reasonably well with those obtained from an alternative solution to this problem given by Sharpe and Heim. A variational solution is then given for the scattering coefficients at the junction of an empty rectangular waveguide with one which is loaded with a transversely magnetized full height ferrite slab. This solution is found to be very slowly convergent except in that range in which the ferrite loaded waveguide propagates the surface wave mode alone.

The variational solutions described above are made possible by preliminary analysis leading to the correct formulation of the integral equation for the discontinuity. This preliminary analysis includes studies of the mode functions of arbitrary uniform waveguides, of their orthogonality properties and of the corresponding modal representations for the Green's operators for such waveguides. Among the more important results in this area is the demonstration that the far fields excited by a point source in an arbitrary passive dissipationless uniform waveguide are described by a superposition of propagating modes, each of which contributes to the far field only in that direction for which its power flow is directed outward from the source. This is true even if, as is often the case in anisotropic waveguides, the direction of net power flow for a propagating mode is opposite to its direction of (phase) propagation. The proof given is based on the known properties of the frequency dependence of the physical parameters of any linear passive system in which the causality restriction is satisfied.

The second major area of preliminary analysis concerns the properties of the propagating modes of the ferrite slab loaded waveguide when the slab is located against the narrow wall of the waveguide. The anomalous situation (leading to a thermodynamic paradox), in which there exists only a single propagating mode transporting energy in one direction only, is shown to be associated only with the surface wave mode. This motivates a thorough study of the TE_{no} surface waves guided along a ferrite-air interface. One of the infinite propagation constant solutions which are allowed for these surface waves is shown to behave in a curious discontinuous manner. This result is then used to resolve the thermodynamic paradox mentioned above by demonstrating that

in the slab loaded waveguide with the slab away from the waveguide wall there are always an even number of propagating modes, half of which transport energy in one direction, half in the other, and that this situation is maintained even in the limit as the distance between the slab and the waveguide wall goes to zero.

Microfilm $2.80; Xerox $9.60. 213 pages.

SEQUENTIAL CIRCUIT THEORY.

(Publication No. 22,945)

William J. Cadden, Ph.D.
Princeton University, 1957

The fundamental concepts in sequential circuit theory are developed - the abstract model, the truth table matrix, the state diagram, equivalent state theory, operational modes, row merging, adding states, etc. The partition table is defined and shown to furnish a mechanistic procedure for reducing a complete truth table matrix.

Three logical modes of operation for sequential circuits are defined in terms of the structure of the truth table matrix and the type of motion of an operating point in this matrix. These modes are related to the usual intuitive notions of synchronous and asynchronous circuitry. Equivalence of circuits operating in the different modes is defined, and transformations between these modes are given.

Methods of physically realizing the different operational modes are discussed, and examples from various technologies are given. Many of the practical difficulties that occur are pointed out.

Some of the concepts involved in cascaded sequential circuits are considered. Transformation procedures forgoing from a cascade to a single circuit, and vice versa, are presented.

The concepts of serial-equivalent circuits and parallel-equivalent circuits are defined, and transformation procedures are given for obtaining these circuits. Transformation procedures are also given for introducing and removing delay in a given sequential circuit.

Areas of sequential circuit theory which the author feels need further study are pointed out.

Microfilm $3.65; Xerox $12.40. 284 pages. Mic No. 59-5014

CROSS SECTIONS OF LARGE CYLINDERS BY THE VARIATIONAL METHOD.

(L. C. Card No. Mic 59-2337)

Edward Spencer Cassedy, Jr., D.Eng.
The Johns Hopkins University, 1959

The electromagnetic field scattered by a conducting body large compared to wavelength may be computed with an accurate knowledge of the induced currents on the surface of the body. Work has been done by Logan and Rabinowitz on this basis using Fock's currents.

The variational method offers an alternative procedure for computing the far scattered field, in that computations may be made with only an approximate knowledge of the induced surface currents. Kodis has formulated the total scattering cross section of cylinders large compared to wavelength by this method. In the present work the differential scattering cross section versus angle of observation for large cylinders is found by the same method.

The trial functions used for the induced surface currents are the physical optics approximation on the surface of the cylinder plus a trial function on a hypothetical plane which intersects the body at the shadow line. The trial function on the plane is the unperturbed incident field plus a correction function which decays with increasing distance from the body.

The results of carrying this formulation through the variational procedure will be found to be as follows:

1. The "reflected" ray as predicted by simple optics is found, just as it would have been from a straightforward evaluation of the problem without the fictitious plane. This results from stationary phase evaluation of the far field integral of the "physical optics approximation" of the induced currents on the cylinder.

2. The half-space formulations yields an explicit term for the "shadow-forming" beam, which is not available from the free space formulation.

3. The variational procedure also yields additional terms of lower order from which we could expect to observe such detail as "creeping wave" interference patterns in the far field. Inspection of these terms, however, shows that they contain no accurate information of this type. This is clear when we observe that the results are equal in the two cases of polarization, which is in obvious violation of what we know from the exact series formulas.

4. The only point of difference between the solutions found for the two cases of polarization was that due to a term resulting from the introduction of the fictitious plane and not the variational procedure. This term can only be evaluated to an unknown O(1).

We then draw the following conclusions concerning the results found by the variational method as applied here: The half-space formulation yields the shadow beam, in addition to the optical reflected ray. Additional fine detail of information, such as "creeping wave" interference patterns, are not available from the results of the application of the method.

Microfilm $2.35; Xerox $8.20. 180 pages.

EXTENDED INTERACTION KLYSTRONS WITH TRAVELING-WAVE CAVITIES.

(L. C. Card No. Mic 59-3702)

Hellmut Paul Oskar Golde, Ph.D.
Stanford University, 1959

Klystrons with extended interaction regions, e.g., sections of slow-wave structure, can have a larger gain-bandwidth product and higher efficiencies than conventional klystrons. This study pertains to a new type of extended interaction cavity, consisting of a closed transmission line

loop which will support a traveling wave if the loop is properly excited. Two methods of excitation, both using a directional coupler, are described. An electron beam can interact with this traveling wave over part of the closed loop.

A general theory of the traveling-wave resonator in the absence of an electron beam is given. The important parameters for interaction with an electron beam are derived. Measurements on an experimental cavity agree very well with theory.

This work includes a discussion of the effects of electron beams on the field distribution in the cavity. If the interaction length is of the order of a few wavelengths or shorter, the field distribution is not materially altered, and the beam can be represented by a positive or negative beam-loading admittance in the same way as in conventional klystron cavities.

The output cavity of a klystron is generally operated under large-signal conditions. In order to obtain maximum energy conversion (high efficiencies) the field amplitudes on the interaction line have to be properly adjusted. An external loading scheme is described which allows the adjustment of the ratio of the field amplitudes on both ends of the interaction structure within certain limits. A backward wave will also be excited by this arrangement; its amplitude can be adjusted to a minimum by simple means.

The beam-coupling coefficient and the beam-loading admittance under small-signal conditions have been calculated and are presented in graphical form. The stability of operation of a klystron using traveling-wave cavities is compared with one using standing-wave cavities. For equal R/Q, the traveling-wave cavities require a lower loaded Q than standing-wave cavities in order to prevent self-supported oscillations.

A number of numerical examples for a connected-ring structure as the beam-interaction line have been worked out and are presented in tabular form. These examples are given for a proposed multi-cavity klystron operating at an rf power level of about one megawatt. The differences of operation at and off synchronism with the electron beam, especially with regard to stability, are discussed. Typical numerical results are as follows: the impedance parameter R/Q is of the order of 200 to 300; the beam-coupling coefficient is of the order of unity; and the loaded Q is of the order of 50. These numbers indicate that the proposed amplifier has a larger bandwidth for substantially the same gain than conventional klystrons.

Microfilm $2.00; Xerox $6.80. 145 pages.

THEORY OF ACOUSTIC HORNS.

(L. C. Card No. Mic 59-3626)

Stanley Greenblatt, D.E.E.
Polytechnic Institute of Brooklyn, 1959

Adviser: William R. MacLean

A theoretical and experimental study of the validity of Webster's horn theory has been made. An operational technique due to Lagrange and Rayleigh has been successfully employed for the first time, its previous use by Rayleigh having been unsuccessful. The Webster horn equation is found as a first approximation to the velocity potential on the axis of the horn only. The potential off the axis is, in general, a power series expansion of a differential operator acting on the axial potential. By this procedure, it is shown that the plane wave assumption used by Webster is unnecessary. While the Webster solutions are of the form $e^{-\alpha z} e^{\pm j\beta z}$, in the second approximation, additional waves of the form $e^{+\alpha z} e^{\pm j\beta z}$ appear. Only the Webster waves carry power, however, the higher order waves serving only to distort the sound pressure pattern in the horn. Experimental data indicate that the accuracy of Webster's equation in predicting the throat impedance is much better than had previously been realized.

In determining the reflections at the mouth of the horn, a variational procedure, Galerkin's method, has been used in conjunction with a symmetry argument for evaluating the resulting integrals in closed form.

The operational method has also been used to obtain certain expansions used in electrostatic electron optics, in a greatly simplified manner. A final application to electromagnetics shows that the transmission line equations for a particular tapered line can be derived without recourse to the T.E.M. assumption.

Microfilm $2.00; Xerox $4.40. 84 pages.

LUMPED MODELS OF DRIFT TRANSISTORS FOR LARGE SIGNALS.

(L. C. Card No. Mic 59-3705)

Paul Gene Griffith, Ph.D.
Stanford University, 1959

This study presents a method for determining lumped models (lumped equivalent circuits) of drift transistors for large-signal operation. The theory of operation of the drift transistor is explained in terms of the physical phenomena. The transit time of injected minority carriers through the base region is found to be an important property for determining the frequency characteristics of the transistor. From the transit-time considerations, together with the phenomena which describe the base region, the complexity of the lumped models for each transistor configuration can be anticipated. Each element or generator in the lumped model is closely related to a physical phenomenon which makes the lumped model a useful circuit for visualization purposes. The model parameters are determined from the steady-state minority carrier density in the base region.

After a lumped model has been derived to approximate the base region, modifications are considered which will account for other effects that were not included in the base-region analysis. The addition of the emitter and collector transition capacitances is a sufficient modification for most purposes. Other effects, which will cause the models to be inexact, are indicated for completeness. After these effects have been considered, lumped models are given for the common-emitter, common-collector, and common-base configurations.

Several drift transistors were tested experimentally to verify the adequacy of the lumped models for large-signal

operation. These transistors were tested for a number of different cases to illustrate various aspects of the model. The experimental results demonstrate that the lumped models are quite adequate for the design of pulse circuits.

Microfilm $2.00; Xerox $6.80. 145 pages.

SYNTHESIS OF OPTIMUM FIELDS FOR ELECTRON BEAM DEFLECTION SYSTEMS.

(L. C. Card No. Mic 59-3627)

Josef Gross, D.E.E.
Polytechnic Institute of Brooklyn, 1959

Adviser: M. Ettenberg

The aberrations of electron-beam deflection systems have recently become important in the design of wide-angle color kinescopes, where high standards of color purity and fidelity of reproduction impose strict specifications on the deflection system. In this dissertation the aberration theory of deflection fields is extended to the synthesis of optimum fields for deflection systems with prescribed electron-optical performance.

First, a unified treatment of the third-order aberration theory of electric and magnetic deflection systems is presented in a form suitable for experimental verification and for design. To this end the results of the theory are formulated in approximate simplified expressions for the aberration coefficients in terms of the cardinal quantities of the deflection system and the detailed distribution of the deflection fields. Then a catalog of representative patterns of misconvergence of the three primary color images in a color kinescope is given as an experimental aid in diagnosing the aberrations of a deflection system from an unconverged test pattern which it scans on the kinescope. Further, criteria for physical realizability of prescribed aberrations by conventional magnetic deflection systems with time-invariant field distributions are derived in terms of the cardinal quantities of the deflection system. Validity of the third-order aberration theory and of these results are checked by comparing the observed electron-optical performance of several wide-angle magnetic deflection systems with that predicted from their computed aberration coefficients; the latter are obtained by numerical computation (on an IBM 650 calculator) from the measured field distribution functions characterizing the deflection fields.

Next, numerical procedures (utilizing the IBM 650 calculator) for the synthesis of optimum fields for wide-angle magnetic deflection systems with prescribed physically realizable aberrations are developed. Means for realizing such optimum fields by shaping the detailed distribution of fields generated by conventional magnetic deflection components through design of their shape and winding distributions are discussed. Validity of the synthesis procedures is established by approximate realization of two quasi-anastigmatic magnetic deflection fields which are the optimum realizable by conventional magnetic deflection systems for color kinescope service.

Finally, where conventional deflection systems cannot realize a desired electron-optical performance, a new class of deflection systems with time-varying field distributions is proposed, and a systematic approach to their design is developed. These new deflection systems are not subject to the same limitations as the conventional deflection systems; they may be designed to be dynamically error free according to a given error criterion.

The third-order aberration theory of deflection and the synthesis procedures for optimum deflection fields with prescribed aberrations based thereon provide valid information for the design of optimum deflection systems with angles of deflection up to 35^0, and serve as a guide for improved design of deflection systems with angles of deflection up to 45^0.

Microfilm $3.05; Xerox $10.40. 234 pages.

HOLLOW-BEAM FOCUSING WITH COMBINED RADIAL ELECTROSTATIC AND PERIODIC MAGNETOSTATIC FIELDS.

(L. C. Card No. Mic 59-3709)

Yukio Hiramatsu, Ph.D.
Stanford University, 1959

A new method of focusing a hollow cylindrical electron beam is presented. The focusing system consists of a cylindrical center conductor inside the beam, a cylindrical outer conductor enclosing the beam, and a series of periodic magnets outside the tube. A radial electrostatic field between the conductors provides an outward force on the electrons. The periodic magnetic field produces an inward force on the electrons. The inward and outward forces can be adjusted to provide a balance of all of the forces acting on the electrons at both boundaries of the beam by choosing the electric and magnetic fields properly.

An approximate analysis has been made and is presented which gives necessary design information. A number of curves are presented which are useful in designing focusing systems of this type.

Experimental results on a beam tester show that current transmission of over ninety percent for perveances up to 11×10^{-6} amp/volt$^{3/2}$ can be obtained readily. The adjustments are not critical and the performance is very stable.

A competitor of this system uses periodic electrostatic fields. The periodic magnetic structure of this system is larger in size and heavier in weight than the periodic structure for the competing system. However, this system is completely independent of the r-f circuitry while the periodic electric system is not. This focusing method should be quite useful for applications in a number of types of microwave tubes.

Microfilm $2.00; Xerox $4.80. 91 pages.

NOISE IN DIGITAL COMPUTER CIRCUITS.

(L. C. Card No. Mic 59-3892)

Robert Blackburn Kerr, D.Eng.
The Johns Hopkins University, 1959

A theory for the passage of stationary noise through diode logic circuits is presented. The main contributions of this theory are:

1. The technique of calculating the exact output probability distributions (and hence error-probability versus signal-to-noise ratio) when the inputs of diode logic circuits are corrupted with additive noise of known statistics;

2. An approximation technique (and its range of application) applicable to more complicated circuits, when the exact technique is cumbersome;

3. A specific study of Gaussian noise through binary addor circuits, with some experimental verification of the applicability of the theory to non-ideal "real-world" circuits;

4. Some generalizations which are applicable to circuits of any degree of complexity. The results derived in this section include the following:

   a) The output probability distributions sometimes do and sometimes do not depend upon what circuit configuration is used to realize the logic function, and the conditions for each case are investigated.

   b) If a threshold equal to one-half the pulse height of the pulses representing 1's in the circuit is set on the output, then the error-probability does not depend upon how the logic function is realized, nor does it depend upon whether the detection process is done at the input or the output of the circuits.

   c) Using the approximation techniques, an upper bound is always obtained on the error-probability, regardless of how the logic function is realized.

Microfilm $2.00; Xerox $4.00. 73 pages.

THE RELIABILITY PROBLEM IN DIGITAL COMPUTER NETS.

(L. C. Card No. Mic 59-3930)

William Lawrence Kilmer, Ph.D.
University of Michigan, 1959

The purpose of this study was to evolve and specify some logical design procedures for inserting redundancy into digital computer nets to make them more reliable. The study is based on the familiar "and," "or," and "not" components. These components operate in discrete time, and with one or zero units time delay. An upper bound is assumed on their probabilities of failure which is compatible with failure rates that have been recorded in current practice.

The development of particular results is begun in the 2nd Chapter of the thesis. There, a "2k + 1" form of binary output net is defined which has the property that its outputs are entirely unaffected by any set of k or fewer component failures which occur within the net. The form is conjectured to be the most economical one for nets which do not contain any feedback loops within them and which have this failure-correcting characteristic.

In the 3rd part of the study the 2k + 1 method is used to derive k-correcting memory nets which are probably the most economical ones capable of regenerating their own storage states. This regenerative capacity is a necessary feature for failure-correcting memory elements that must perform long-term storage services, for these elements must be set and reset through imperfect components which may fail intermittently. Hence, the accumulation of the effects of intermittent mistakes must be prevented by constant state regeneration.

The 4th part of the study concerns the specification of two economical forms of over-all k-correcting computer nets. Both these forms are based on a common computer representation which is composed of a pure memory subnet and a combinational subnet. The first form is made up entirely of 2k + 1 type nets, and so has all its redundancy in the equipment domain. The second form has as much of its redundancy shifted to the time domain as possible. This is effected by using a k-degree failure detecting rather than k-degree failure correcting combinational subnet. The form's operation is based upon an arrangement whereby the outputs of its combinational part are ignored unless they contain purely correct information. The possibility of having permanent failures in the combinational subnet of the form is allowed for by the addition of reserve nets. These nets are automatically switched into operation from standby locations to replace operational nets containing permanent failures. In every case, either the first or second form is probably the most economical k-correcting computer representation of the general two-subnet form indicated above.

The last part of the study is begun with an explanation of the merger technique. This technique is used to derive some results on k-degree failure detecting nets which have m wires, $m > 2$, in each of their binary output channels. An outline of a procedure for most economically constructing such nets is given, and it is shown that by using the merger technique, k-correcting nets can also be made q-degree failure detecting, for arbitrarily high q.

Microfilm $2.00; Xerox $5.20. 103 pages.

AN ANALYTIC HYSTERESIS FUNCTION.

(L. C. Card No. Mic 59-3893)

Foster Hugh Middleton, D.Eng.
The Johns Hopkins University, 1959

An analytic hysteresis function containing three parameters has been introduced. Methods have been given for determining the parameters to accomplish a synthetic loop "match" with a given experimental loop. The "matching" capabilities of the synthetic loop were demonstrated on cases of widely differing loop shape, from strain-free transformer steel (with a rounded hysteresis loop) to a highly strained, grain-oriented silicon steel (with a "rectangular" loop shape). The limitations of the analytic function in the case of for example,

"wasp-wasted" loops or loops having extremely stretched-out tip regions, are discussed.

Two kinds of application of the analytic hysteresis function were presented with examples of each. The first made use of the function parameters and the second kind of application involved the functions themselves.

Tracking the parameters could be useful for any number of test condition variations, but the one chosen as an example employed a minor loop family for one material to show the parameter trajectory in a polar plot as the maximum induction was increased in steps. Also, the parameter changes induced by stress-relief annealing were determined for two different materials.

The direct application of the analytic hysteresis function was made in three ways, although as before, these three ways are presented as examples. Expressions were derived for the Fourier series coefficients of induction, given sinusoidal intensity variation and also for the Fourier series coefficients of intensity given sinusoidal induction variation. These expressions were applied in a comparison with experimental results obtained by another investigator.

The second application of the function itself resulted in an expression for hysteresis loss in terms of the function parameters. This expression was also checked against experimental data.

Finally, it was shown that the analytic function was readily applicable to use on an analog computer. A sequence of cathode ray oscilloscope photographs is given to show the loop shape variations as the function parameters are modified in the computer.

Microfilm $2.00; Xerox $3.00. 59 pages.

EXPERIMENTAL INVESTIGATION OF MAGNETRON AMPLIFIER THEORY.

(L. C. Card No. Mic 59-3633)

Hilding M. Olson, Jr., D.E.E.
Polytechnic Institute of Brooklyn, 1959

Adviser: Morris Ettenberg

Over the past several years a number of theoretical analyses of the amplification mechanism in a magnetron amplifier has been published. It has been the purpose of this investigation to consider some of these theories from the point of view of the tube designer comparing them as to ability to furnish accurate quantitative predictions of actual performance, as to simplicity, and as to ability to furnish a physical picture of the amplification process.

The quantitative evaluation was accomplished from measurements made on a pair of linear forward wave amplifiers with external slow wave circuits operating in the neighborhood of 100 mc. By measuring the rf potentials at each section of the slow wave structure the gain could be determined as a function of the operating parameters of the amplifier. It was found that the small signal theories, in which the space-charge forces in the beam were neglected, yielded too low values of gain. A rather simple small signal treatment of the problem by Gould, in which the space-charge forces are accounted for by assuming the beam to be a rippling infinitesimally thick sheet of charge, produced excellent agreement between computed and measured gains. In order to make calculations with this theory it was necessary to measure the width of the unperturbed beam. Measurements of the distribution of ion current arriving at the sole were used to determine this quantity. From data obtained by Dain, Craston, Holmes, and Weaver on an S band linear amplifier, it was confirmed that the above results apply also to amplifiers for microwaves.

Although quantitative evaluation of a large signal theory by Feinstein and Kino could not be made, the qualitative features were verified upon operating one of the low frequency amplifiers at large signal levels.

Of the small signal theories it was concluded that the thin beam space-charge analysis is best for engineering purposes, since it is accurate, relatively simple, and conveys a good physical picture of the amplification process. The space-charge-free theories are inaccurate for practical values of beam current and the thick beam theories are quite complicated without yielding better accuracy than the thin beam model. The Feinstein-Kino analysis is at least qualitatively correct in describing amplifier performance at large signal levels.

Microfilm $2.10; Xerox $7.40. 156 pages.

THE ANALYSIS AND DESIGN OF CONTINUOUS AND SAMPLED-DATA FEEDBACK CONTROL SYSTEMS WITH A SATURATION TYPE NONLINEARITY.

(L. C. Card No. Mic 59-3721)

Stanley Francis Schmidt, Ph.D.
Stanford University, 1959

The problem studied in this investigation is how to design and analyze feedback control systems in which a saturation type nonlinearity, or limiter, occurs on the input to the controlled system, or "plant." The plant is assumed to have one input and one output and to be describable by linear differential equations with constant coefficients. The scope of the investigation covers plants whose transfer functions are of first to fourth order.

As a result of the assumption of linearity and the fact that limiting has no effect for small signal inputs, the feedback control system can be designed by the use of conventional, linear feedback control theory for the small input signal range. The problem then becomes how one can analyze the response of the system for large signal inputs which cause saturation and how to design compensating nonlinear functions which will improve the response should the analysis show this to be necessary.

The root locus and the switch time methods are used in this investigation for solution of the problem. The application of the root locus method is conventional with the exception that the limiter is treated as a device whose equivalent gain decreases as its input increases. It is shown that a root locus graph with respect to the limiter gain gives a qualitative indication of the system response as a function of input amplitude. The switch time method is based on the use of step inputs for analysis and design purposes. It provides the control system designer with the following:

(1) A means for analysis of saturated control systems to determine the size of the step inputs which cause poor performance.

(2) A means for quickly calculating the response time for large step inputs.

(3) A means for synthesizing nonlinear functions which provide near optimum response for large step inputs.

The switch time method uses the optimum bang-bang solution for step inputs. It is shown that if the first reversal time after the application of the step is longer than the bang-bang solution, overshoot must exist. By forcing the first reversal time to be the optimum relay solution one obtains the method for synthesizing nonlinear functions which provide near optimum response for large inputs.

A number of optimum bang-bang first reversal times and minimum response times are derived and presented in normalized form.

The switch time and root locus methods are applied to several aircraft autopilot examples where the rate of control-surface motion is limited. Both sampled-data and continuous systems are presented. The results of simulation studies demonstrate the validity of the approach.

It is generally concluded that the combination of the switch time method along with certain root locus techniques offers a very powerful tool for analyzing and designing both sampled-data and continuous systems in which a saturation type nonlinearity is present.

Microfilm $2.00; Xerox $5.60. 114 pages.

CONTROL ASPECTS OF VERY HIGH FLUX RESEARCH REACTORS.

(L. C. Card No. Mic 59-3887)

Antonio C. Didier B. Vianna, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: Colon H. Dunn

This work is directed toward the computation of reactor characteristics over a fuel cycle in a way suitable to the investigation of the control aspects of the reactor problem.

The high flux operation of the type of reactor under consideration has required the study of the dynamic problem including as independent variables the neutron energy, the space and time. An additional condition of versatility in the method used to obtain the solutions, is necessary to explore the control aspects of the problem.

These general premises have placed the problem beyond what is published in the literature and rule out the digital computers and hand numerical computations as suitable methods to obtain the solutions. The accuracy necessary for control study and the condition of versatility imposed have suggested its solution by analog methods. The problem as presented, however, is beyond the standard use of the analog machines. The normal possibilities of the analog computers were surveyed and a method was found to solve the reactor dynamic problem.

The classical approach of considering the neutron energy dependency in groups and the spatial dependency in reactor regions is used. Only cases of regular symmetry are considered, so that the reactor three dimensional configuration is reduced by analytical methods to the study involving one space coordinate. Time is considered as a continuous variable.

Full advantage is made of the peculiarities of the reactor operation. Since only long term solutions are considered, the short term variations, such as neutron kinetics and reactor servo control, act as the average effect of keeping the reactor critical during operation. This fact has suggested the idea of representing the flux distribution in a steady-state basis and superimposing onto this solution the slow time varying parameters. This scheme can be handled in an analog machine provided the reactor critical condition during operation is assured and the spatial solution is not disturbed by the superposition of the time solution. To satisfy the first requirement a criticality calculator and control poison simulator are included. The second requirement is met by eliminating any sort of time delay in the flux simulator. This was accomplished by replacing the diffusion differential equations with a first order finite difference approximation. The power produced in each core region is added up to the total desired reactor power output. This sum is maintained constant automatically and sets the level of the flux distribution accordingly, as the uranium is depleted.

The Mighty Mouse reactor (A-Conf 15/P/423-1958) is simulated and the analog results compared against published data. With the spatial dependency represented by three core and three reflector regions, the fast and slow flux distributions are within 5% of the digital computer solution of the same problem. At the end of the fuel cycle, the flux distribution is essentially that of the digital solution with the values lowered 5 to 10%. Compared with hand numerical computations made considering the same number of core regions, the analog results show agreement with 1%.

Some fundamental aspects of the long term reactor dynamics are discussed, based on results from the simulator. Illustrative examples of power transients, shut-down, control by burnable poison and localized control rods are included and discussed.

The method of solution presented does not replace or overlap with existing methods. It is felt that considerable time can be saved in the reactor project by a combined use of the available methods, including this analog method. The procedure is not bounded by any empirical or numerical limitation. Thus, its field of application is open for long term reactor problems in general, provided the equations representing the reactor operation are properly introduced into the analog machine. It can also be used as a pedagogical aid in demonstrating advanced reactor theory concepts.

Microfilm $2.00; Xerox $5.40. 107 pages.

TIME LAGS IN THE ELECTRICAL BREAKDOWN OF MOVING AIR.

(L. C. Card No. Mic 59-3896)

John Linton Walters, D.Eng.
The Johns Hopkins University, 1959

Delays have been measured in the formation of sparks across an air stream in a wind tunnel. Delays in the range of 3 to 60 seconds have been found to increase with velocity. An increase of 2% in dc breakdown voltage in going from 20 to 40 meters per second was observed. The existence of a relatively slow, invisible, prebreakdown mechanism is indicated, which may play a part in the formation of sparks in nonilluminated gaps with small over-voltage. Microfilm $2.00; Xerox $4.80. 95 pages.

A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF DIELECTRIC WAVEGUIDES FOR USE AT HIGH MICROWAVE FREQUENCIES.

(L. C. Card No. Mic 59-2338)

James C. Wiltse, D.Eng.
The Johns Hopkins University, 1959

A formal solution has been obtained for the problem of wave propagation on a dielectric rod of elliptical cross section, and several general conclusions have been drawn from the resulting field equations. Obtaining specific values of guide wavelengths, cutoff frequencies, and other numerical data for various modes has, however, been shown to be very difficult and time consuming and has not been carried out.

A companion experimental investigation has shown that it is possible to construct dielectric image lines which have low attenuation and small field extent when used in the frequency region from 30 to 80 kmc. In order to reduce attenuation the effects of using low dielectric constant materials and/or various shapes of the dielectric cross section were studied. The dielectric constants and loss tangents of three new foam polystyrene materials with very small cell sizes have been determined at frequencies near 35 and 70 kmc. These materials have such good properties that they should be useful for many purposes at millimeter wavelengths.

Various image line components have been built and have given satisfactory performance at 35 and/or 70 kmc. Shields of moderate size have been shown to be practicable. A description is given of a new type of image line, called the tape line, which has the advantages of low attenuation and ease of construction.

Microfilm $2.00; Xerox $5.80. 120 pages.

AN ANALYSIS OF SOLID ROTOR MACHINES.

(L. C. Card No. Mic 59-3890)

Allen J. Wood, Ph.D.
Rensselaer Polytechnic Institute, 1959

The specific problem studied in this thesis is the derivation from Maxwell's field equations of the terminal and equivalent circuit impedances for polyphase electrical machines with solid iron rotors. As an extension of this main objective, the effects of curvature, finite machine length and saturation on these impedances are studied by considering additional machine models. The analyses are made for simplified models of machines with smooth air gaps. The assumption is made that the armature and field winding leakage inductances and resistances are external to the geometry studied. The derived impedance equations are evaluated for quasi-stationary operating conditions.

The procedure followed is to analyze first a simple, flat machine model which is infinitely long. With the aid of this model the electromagnetic boundary value problem is solved for the vector magnetic potential and with the field quantities determined, the terminal operational impedances are developed in terms of the direct and quadrature axes components, $x_d(p)$ and $x_q(p)$. The direct and quadrature axis equivalent circuit impedances are derived from the field quantities by mathematically simulating open and short circuit conditions in the machine windings and eddy current paths. The impedances thus found are then related to the machine geometry, winding characteristics, and the properties of the rotor iron in such a way that the final relationships are expressed in the per unit system of conventional synchronous machine theory.

Next, a model machine consisting of concentric cylinders is analyzed to show the effects of curvature on the impedances. A third configuration consisting of a flat model of finite length is then considered to simulate the end effects encountered in actual machines. In the first three models studied the rotor iron was assumed to be a linear medium. For the consideration of rotor iron saturation effects the fourth section of the analysis assumes an infinitely long, flat model and considers the rotor iron to have a rectangular magnetic saturation characteristic. Finally, the various theories are examined experimentally by means of blocked rotor tests on a solid rotor machine.

The findings which are presented in the thesis consist of operational equations for both the terminal and equivalent circuit impedances which may be used with well established techniques to study the performance of solid rotor machines. Numerical evaluations of these equations are presented for quasi-steady state conditions as a function of the machine parameters and the frequency of the rotor iron currents. These data may be used both to analyze performance and to synthesize machines since the data cover a wide range of machine parameters. The experimental data given illustrate the importance of saturation in modifying the machine impedances.

As a result of this investigation several conclusions may be drawn.

1. The terminal and equivalent circuit operational impedances of machines with solid rotors may be derived from Maxwell's equations.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

2. These impedances for quasi-stationary conditions and when expressed in a normalized or per unit system, are functions of the following dimensionless ratios and the air gap magnetizing reactance:
   (1) air gap length to pole pitch,
   (2) pole pitch to depth of penetration,
   (3) field leakage to air gap inductance,
   (4) relative rotor iron permeability, and
   (5) pole pitch to axial length.
3. Curvature has a negligible effect on the solid rotor impedances except where the ratio of pole pitch to the depth of penetration of the rotor iron eddy currents is very small.
4. Finite axial length has a negligible effect on the solid rotor impedances for machines in which the ratio of pole pitch to axial length is less than one-half.
5. Both theory and experiment indicate that rotor iron saturation is very important in modifying the solid rotor impedances.

Microfilm $3.05; Xerox $10.60. 236 pages.

ENGINEERING, MECHANICAL

THE TRANSIENT THERMAL RESPONSE OF A STEP PRESSURIZED BOILING LIQUID NITROGEN SYSTEM.

(L. C. Card No. Mic 59-3924)

Saul Fenster, Ph.D.
University of Michigan, 1959

Liquid nitrogen, boiling at constant wall heat flux varying from approximately 1200 to 4200 BTU/Hr.Ft^2 in a cylindrical container was rapidly pressurized with ambient nitrogen gas. Two levels of pressurization were used, 20 and 35 psig.

Primary instrumentation provided means for measuring wall and liquid temperature transients at various locations, nitrogen boiloff, and electrical power input.

If was found that upon pressurizing the boiling liquid, boiling ceased, and thereupon followed in sequence a single-phase convection process, two-phase convection, and finally re-established boiling at the new pressure.

Assuming that the step-pressurization causes a step decrease in the heat transfer coefficient, a theoretical analysis was made to predict wall and average liquid temperature transients.

Actually, the heat transfer coefficient does not decrease step-wise upon pressurization. Its transient behavior is instead characterized by a rapid rate of decrease, a minimum point or dwell period depending upon the longitudinal location and flux, and finally a rapid increase until steady boiling is re-established.

It was deduced that no bubbles have formed up to the time of the minimum heat transfer coefficient. The rise of the coefficient after the minimum is attributed to the very first vapor bubbles forming and the associated fluid agitation.

During the period between the pressurization and the time the minimum in coefficient is reached only two effects were presumed to influence the transients. These are:

1. The viscous deceleration of the high liquid turbulence due to boiling before pressurization. This tends to decrease the heat transfer coefficient.
2. The increasing contribution of free convection, since during the time interval under discussion the difference in temperature between the wall and the liquid, at a given location from the cylinder bottom, is increasing.

In order to prove the validity of the above description, it was necessary to subtract the free convection contribution from the experimentally determined heat transfer coefficient for the period from pressurization to the minimum coefficient. At the dwell period of the coefficient, it was reasoned that the effect of initial turbulence due to boiling had completely decayed, and the heat transfer coefficient was due entirely to free convection. Since the usual correlation for free convection from vertical surfaces gave values of the heat transfer coefficient which were too high, the constant in the correlation was adjusted on the basis of the experimentally determined minimum value. Using the new correlation, the free convection effect was subtracted from the transient coefficient and the remainder assumed to be due entirely to viscous deceleration of the liquid. This was supported by showing that the diminution of the contribution due to initial turbulence was a first order effect, characteristic of viscous deceleration.

Assuming that the fluid motion inside the cylinder was characterized by an upward moving shell at the cylinder wall, and a downward moving core, and that no mass or heat diffusion occurs between the two, a method was devised to approximately calculate core velocities.

Such calculations showed that the liquid core velocity decreases as the cylinder bottom is approached, a result anticipated since the downward component of the core velocity must be zero at the bottom. This explains why the heat transfer coefficients were found to decrease as the distance above the bottom decreases.

Calculation of the velocity history of the fluid at a particular longitudinal location showed a rapid deceleration of the liquid after pressurization. This serves to substantiate the diminution of the heat transfer coefficient due to viscous effects.

Microfilm $2.15; Xerox $7.60. 161 pages.

INTERFEROMETRIC STUDY OF THE STEADY STATE AND TRANSIENT FREE CONVECTION THERMAL BOUNDARY LAYERS IN AIR AND IN WATER ABOUT A UNIFORMLY HEATED VERTICAL FLAT PLATE.

(L. C. Card No. Mic 59-3746)

Richard J. Goldstein, Ph.D.
University of Minnesota, 1959

A Zehnder-Mach interferometer was used to study the free convection thermal boundary layer about a

uniformly heated vertical flat plate. Experiments were performed when the plate was immersed in water as well as in air. In addition to the steady state boundary layer the transient development of the boundary layer, from an initial state of fluid and plate at the same temperature and quiescent fluid to steady state conditions, when a step function in power input to the plate is applied, was examined.

The various plates used were made of thin (approximately .001" thick) shim stock and were heated by passing on electric (d.c.) current through them. Under certain conditions the system approximated the boundary condition of uniform (with position) and constant (with time) heat flux by conduction and convection from the heated sheet into the fluid. This is the boundary condition that was sought in most of the experiments.

Results for the steady state runs at approximately uniform heat flux are presented in graphical form. These check the available theoretical treatment. Maximum values of heat input per unit area of surface and local Grashof number were approximately 60 Btu/hr ft^2 and 7 x 10^6 for the air runs and 130 Btu/hr ft^2 and 6 x 10^6 for the water runs.

The results for runs of non-uniform heat flux indicated that under certain conditions local values of the heat transfer coefficient could be calculated by using the theoretical treatment for a power law variation of wall temperature difference with distance from the leading edge.

Transient runs were performed over approximately the same range of heat inputs as for the steady state experiments. A clearly definable interval during which heat transfer to the fluid was by pure one-dimensional conduction was observed. The experimental results compared well during this interval with a theoretical conduction solution for constant heat input to the sheet. The steady state which was eventually attained checked results of the earlier tests. The transitional period between these two extremes seemed very short particularly if one only examined the variations in wall temperature and heat transfer coefficient with time. No overshoot or undershoot with time of the steady (or quasi-steady) state values was found. It appears that heat transfer for the type of transient heat input studied could be adequately predicted from theoretical calculations for one-dimensional conduction and the results available from steady state analysis. The transition from pure conduction to a steady (or quasi-steady) state boundary layer would then be calculated as the time when the heat transfer coefficients (and/or wall temperature) at a particular position were the same for the two limiting cases. An overshoot in boundary layer thickness was discerned during the transient runs, particularly those in water. The boundary layer grew till it was thicker than the steady or quasi steady state value and then diminished in size.

Qualitative heat transfer results were obtained when the heat input to the sheet is suddenly reduced to zero after steady state had been attained and also for a simple volume heating situation.

Microfilm $2.15; Xerox $7.60. 161 pages.

OSCILLATING TANGENTIAL FORCES ON CYLINDRICAL SPECIMENS IN CONTACT AT DISPLACEMENTS WITHIN THE REGION OF NO GROSS SLIP.

(L. C. Card No. Mic 59-3878)

Robert V. Klint, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: Henry T. Nagamatsu

The effects of oscillating tangential forces on cylindrical specimens at relative displacements within the no-gross-slip region have been studied experimentally. The region of no-gross-slip is defined from the work of Mindlin and others as the initial tangential relative displacement within which the area of contact consists of a central no-slip portion surrounded by an annular slip portion. This annular slip portion increases from zero at zero tangential displacement, to the complete area of contact at gross slip.

It is shown here that within this no-gross-slip region there is a well-defined region at the onset of tangential displacement within which the force-velocity Lissajous figures indicate a primarily elastic deformation. Energy dissipation studies indicate that in this region the behavior is essentially visco-elastic, confirming the results of K. L. Johnson obtained by another method that at these smaller amplitudes elastic hysteresis predominates.

This "limit of elastic behavior" has been found for cylindrical specimens of brass, stainless steel, cold-rolled steel, duralumin, diamond, Teflon, Bakelite, Micalex, rubbing on themselves, as well as diamond rubbing on the other materials. For the elliptical contact areas used these values range from 1/2 micro-inch vector for diamond on diamond to 63 micro-inch vector for Teflon on Teflon; for the duralumin specimens this amplitude is 0.65 the amplitude for gross slip.

Within this limit of elastic behavior no discernible wear is observed, even after millions of cycles of rubbing. However, at larger amplitudes, wear is rapid and characteristic of fretting corrosion, especially above the gross slip amplitudes.

In the experimental technique devised here, crossed cylinders of dissimilar radii are pressed together to obtain the elliptical contact area; circular contact area is obtained by using cylinders of the same radius. One of the cylinders is oscillated axially by a vibration shake table through a barium titanate force transducer; the relative displacement of the two cylinders is detected by a probe-type velocity pickup. The results are obtained from study of the Lissajous figures formed by the signals from these transducers.

This technique has also provided values of elastic tangential compliance at the limit of elastic behavior. Good agreement is shown with Mindlin's theoretical analysis for the case of zero slip with elliptical contact area by extrapolating values of measured tangential compliance within the limit of elastic behavior to zero relative displacement. For the circular contact area the experimental values of tangential compliance agree with theory including slip.

From these studies, values of the coefficient of friction beyond gross slip were found and shown to be representative

of uni-directional friction coefficients indicated in the literature.

Measurements were made of the energy dissipation and compared with Mindlin's analysis for the circular contact area. The agreement is good at the larger amplitudes near gross slip, but below the limit of elastic behavior, the agreement is poor. It appears that at the smaller displacements, the primary source of energy dissipation is not the slip in the outer annulus of the area of contact, as Mindlin indicates, but internal hysteresis of the material. As the amplitude of rubbing increases up to the limit of elastic behavior the energy dissipation remains nearly visco-elastic. However, at the limit of elastic behavior the character of the energy dissipation changes abruptly, increasing rapidly with increasing amplitude, in agreement with Mindlin; hence, slip in the annulus is the primary source of energy dissipation between the limit of elastic behavior and gross slip.

Microfilm $2.00; Xerox $5.60. 111 pages.

ENGINEERING MECHANICS

ELASTIC BENDING OF PRETWISTED BARS.

(L. C. Card No. Mic 59-3704)

Donald Spray Griffin, Ph.D.
Stanford University, 1959

It is evident that bars which have a natural twist in the unstressed state -- pretwisted bars -- do not respond to static bending loads in the same way as straight, untwisted bars. Under the action of end couples, the axis of the pretwisted bar will become a space curve. The behavior is influenced both by the varying orientation of the cross section along the bar, and by the helicoidal shape of the boundary.

Stress solutions are obtained within the framework of the linear theory of elasticity for bars with a moderate, constant rate of pretwist. The differential equations and boundary conditions are expressed in terms of stress components referred to coordinates coinciding locally with the principal axes of the bar. By deducing the manner in which these stress components vary along the axis of the bar, the equations are reduced to forms independent of the axial coordinate. Then, observing that the effect of a moderate amount of pretwist is only pronounced when the cross section is thin, the stresses are expressed as power series of the small parameters, thinness and pretwist. The first few terms in the series are determined for the elliptical cross section, and the method is demonstrated for a bar with a uniform cross section symmetrical about the long axis, but otherwise arbitrary in shape. A solution using only a single series expansion in the small parameter, pretwist, is also obtained for the elliptical section. Extension to the more general boundary shape was not possible. Finally, local curvatures due to bending moments in the principal planes of the section are obtained, showing the manner in which the bending stiffness of a straight bar is modified.

The results indicate that a moderate amount of pretwist reduces the maximum stress. There is a corresponding reduction in the bending stiffness, which can be as much as 20% for bars of thin cross section -- compressor blades, turbine blades, etc.

Microfilm $2.00; Xerox $6.60. 137 pages.

THE ELASTICITY SOLUTION OF A LONG CIRCULAR CYLINDRICAL SHELL SUBJECTED TO A UNIFORM CIRCUMFERENTIAL RADIAL LINE LOAD.

(L. C. Card No. Mic 59-3630)

Jerome M. Klosner, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: Frederick V. Pohle

The problem of a long circular cylindrical shell subject to a uniform circumferential radial line load is solved by the three-dimensional equations of elasticity. A Fourier integral transform is used and the inverse is obtained by numerical and asymptotic integration.

The elasticity solution is then compared with a Timoshenko-type shear deformation shell theory and the Timoshenko and Flügge classical shell theories.

Computations have been made for a cylinder having a ratio of internal radius to external radius equal to 0.9 and a Poisson's ratio equal to 0.3($b/a = 0.9$, $\nu = 0.3$). They reveal that the shell theories, which are two-dimensional approximations of a three-dimensional problem, yield excellent results at distances sufficiently removed from the load singularity. In the neighborhood of the load the stresses and displacements cannot be predicted accurately by the shell theories. This is partially due to the fact that the shell theory assumes that the radial line load is applied as a transverse shear. Thus, the shell theory solutions at the plane of the load will lead to large transverse shearing stresses and negligible normal radial stresses, while the elasticity solution yields large normal radial stresses and zero transverse shearing stresses.

Shell theories which include the transverse shear deformation terms give excellent results for the radial deflection even at the plane of the load. However, with this exception, they do not lead to more accurate stresses and displacements.

Microfilm $2.00; Xerox $3.60. 62 pages.

ANALYSIS OF THE LAMINAR COMPRESSIBLE BOUNDARY LAYER CHARACTERISTICS OVER AN ISOTHERMAL FLAT PLATE WITH FINS.

(L. C. Card No. Mic 59-3634)

Adrian Pallone, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: Antonio Ferri

One of the most important problems associated with hypersonic flight is to maintain the temperature of the

various components of the vehicle within the operational limits required.

A convenient method of obtaining this end is to thicken artificially the boundary layer and alter its velocity and temperature profile by means of small streamwise fins installed normal to the surface. In practice these fins could be installed in a region where the surface is capable of radiating more heat than that transferred to it, thus utilizing the fins to extract energy from the air conducting the heat to the radiating surface and leaving low energy air which may be taken aboard and used where cooling is desired. A more direct approach would be to reduce the heat transfer to the main surface by constructing the fins of insulating material and inserting them upstream or in the region where low temperatures are required.

This paper presents a theoretical investigation of the laminar boundary layer characteristic of a flow over an isothermal flat plate with fins. Of practical concern is how the shear stress, the rate of heat transfer and the various boundary layer profiles behave when varying fin spacing, fin height and wall to free stream temperature ratios.

The compressible boundary layer equations are formulated for the flow over an isothermal surface with fins. In order to simplify the problem mathematically and yet retain its salient physical features the equations are then reduced to a two dimensional form by replacing the variation of all quantities in the direction normal to the plane of the fins by average values. The resulting equations are transformed to a quasi-incompressible case by means of Howarth's transformation. By introducing a Blasius-type stream function, the continuity equation is automatically satisfied and it is noted that the momentum equation becomes an ordinary non linear differential equation provided that the average fin shearing stress has a specific variation with the streamwise coordinate (x).

In order to evaluate the effect of the fins on the boundary layer characteristics, a physically reasonable and simple expression for the fin shearing stress is obtained by dividing the fin into strips with each strip behaving as a local flat plate with free stream condition given by the local quantities. The momentum equation is then reduced to an ordinary non linear differential equation by letting the number of fins per unit width vary as $1/\sqrt{x}$. This procedure is valid because in this analysis the fin effect is treated only on the average. The resulting equation is then integrated for various free stream Mach numbers, fin characteristics and wall to free stream temperature ratios. The results are presented in general form and are qualitatively discussed. A specific example of practical interest is also presented.

The wall shear stress and consequently the rate of heat transfer decreases with increasing fin height, decreasing fin spacing and increasing free stream Mach number. Reductions of wall shear and rates of heat transfer on the order of 1/3 the values given for a plate with no fins are possible. No marked change on the rate of decrease is noted when the wall temperature is varied.

The fin shear and rate of heat transfer show a trend opposite to the one stated for the wall. Increases of drag and of the rate of heat transfer are obtained on the order of twice the values given for a flat plate with no fins.

Microfilm $2.00; Xerox $4.00. 73 pages.

ENGINEERING, METALLURGY

THE ISOTHERMAL TRANSFORMATION OF EUTECTOID BERYLLIUM BRONZE AT ELEVATED TEMPERATURES.

(L. C. Card No. Mic 59-4055)

Jack S. Brett, Eng.Sc.D.
Columbia University, 1959

The transformation of eutectoid beryllium bronze has been quantitatively investigated at 550°C and 592°C, the temperature region where the products of beta decomposition are a fine lamellar eutectoid and a subsequent coarse lamellar aggregate which replaces the fine eutectoid with prolonged annealing.

The initial decomposition may be satisfactorily approximated, even though the transformation is not strictly homogeneous, by the simple reaction equation $f(t) = |-e^{-\frac{\pi}{3}NG^3t^4}$, where f(t) = fraction transformed, N = rate of nucleation, G = rate of growth, and t = time. Initial growth rates of the intragranular eutectoid nodules have been determined. The rates are constant with time.

Electron photomicrographic studies, determinations of minimum interlamellar spacing as a function of time at temperature, and experimental reaction curves reveal that the coarse lamellar aggregate forms preferentially in the most densely lamellated regions of the fine eutectoid and favor the hypothesis that the development of the coarse lamellar aggregate in the fine eutectoid is due to the occurrence of the recrystallization reaction rather than an intermediate phase existing only at the reaction temperatures. Microfilm $2.00; Xerox $4.40. 85 pages.

SOLUTE DIFFUSION IN LIQUID TIN.

(L. C. Card No. Mic 59-3756)

Ching Hou Ma, Ph.D.
University of Minnesota, 1959

Solute diffusion of Al, Zn, Ag, Cu and Ni in liquid tin has been investigated by the capillary reservoir method in a temperature range from about 240° C to 480° C. All the solutes investigated were present in dilute solutions ranging from 0.4 at .% to 1.5 at .%. The solutes were chosen so as to cover a range of relative partial molar enthalpies from large positive values to large negative values. On the basis of self-diffusion of Sn it is found that the ratios of D_{solute} to $D_{self\text{-}Sn}$ are 4.70, 1.90, 1.57, 1.15 and 1.10 respectively for Al, Zn, Ag, Cu and Ni. The diffusion coefficients of Cu and Ni can be considered to be identical with that of tin within experimental error. It is also found that within the limits of experimental error the plots of log D versus the reciprocal of the absolute temperature for the five solutes are straight lines the slopes of which are identical. The results are discussed with relation to the Einstein and Eyring equations as well as with the recent fluctuation theory of liquid metal diffusion. It is found that the Einstein and Eyring equations

and the fluctuation theory predict the same slopes, which is however, only about one-half of the found. The Einstein and Eyring equations predict fairly well the magnitude of diffusion coefficients if it is assumed that these solutes diffuse as ions but they do not predict the relative order of diffusion coefficients among the five solutes investigated. It seems, therefore, that factors other than ionic size must be taken into account in evaluating the diffusion constant. The relative order of diffusion coefficients of Al, Zn, Ag and Cu or Ni predicted by the fluctuation theory on the basis of binding energy between solute and solvent atoms is in complete agreement with the experimental results although quantitative application of the fluctuation theory is not feasible. In order to explain the nature of the similarity of the diffusion coefficients among Cu, Ni and Sn it is proposed that the mutual effect of mobilities of Ni and Sn atoms or Cu and Sn atoms should be considered. It is proposed that in dilute solutions the diffusion coefficient of a solute would approach that of solvent metal if the solute has negative partial molar enthalpy in the liquid solvent metal. Microfilm $2.00; Xerox $5.00. 96 pages.

PRECIPITATION OF SILICON FROM A SUPERSATURATED ALUMINUM-SILICON SOLID SOLUTION.

(L. C. Card No. Mic 59-3884)

Herman S. Rosenbaum, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: David Turnbull

The precipitation of silicon (diamond cubic) from a supersaturated Al(1%Si) solid solution (f.c.c.) was studied by resistometric, by X-ray and electron diffraction, and by light and electron micrography. Some micrographic work was also done on alloys containing 0.6 and 1.6% Si. The precipitations were carried out isothermally at temperatures 185° to 370°C.

The precipitation rate and the number of silicon particles nucleated were found to be strongly dependent on the thermal history of the specimen. In specimens quenched from the homogenization temperature (580°C) at moderate rates prior to aging, between 10^6 and 10^{10} particles/cm^3 were found. These were often seen to be aligned in an incomplete network, suggesting nucleation on dislocations or low angle boundaries. In specimens that were more rapidly quenched and then allowed to pre-age for some time at temperatures -40° to + 30°C, the number of precipitate particles was found to be ~ 10^{15} cm^{-3}; and the precipitation rate is correspondingly high.

The profuse nucleation in specimens given the rapid quench and pre-age treatment is associated with the annealing out of quenched-in lattice vacancies. Two alternative mechanisms can explain this profuse nucleation (1) homogeneous nucleation at the pre-aging temperatures in which the quenched-in vacancies provide the required solute mobility and (2) heterogeneous nucleation on dislocation loops that form when vacancy clusters collapse.

The silicon was found to form both plate-like and equi-axed particles. These particles have random crystallographic orientations with respect to their matrix crystal. However, X-ray diffraction patterns showed apparent orientation preferences in specimens that had been rapidly quenched and then pre-aged prior to aging.

Adjacent to the grain boundaries there exists a region depleted of precipitate particles. The width of the depleted region increases with slower rates of cooling from the homogenizing temperature prior to aging. Cold work prior to aging causes particles to nucleate in the depleted region. The depleted region is caused by migration of vacancies to the boundary during the quench.

Microfilm $2.00; Xerox $5.40. 106 pages.

RECRYSTALLIZATION OF COLD-DRAWN SINTERED ALUMINUM POWDER.

(L. C. Card No. Mic 59-3888)

Edwin J. Westerman, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: Fritz V. Lenel

The recrystallization behavior of two sintered aluminum powders of low oxide content, fabricated by hot pressing and hot extrusion and cold worked by drawing, was evaluated in terms of some fundamental kinetic quantities and compared in general with that observed in cold-drawn 2S aluminum.

One powder product, designated AT-400, contained 1.75 per cent Al_2O_3 by weight; it was produced from atomized aluminum powder consisting of spherical particles with an average diameter of 3 μ. The second powder product, designated MD 2100, contained 3.0 per cent Al_2O_3 by weight; it was made from an aluminum powder consisting of flakes of about 0.8 μ thickness. Determination of the effect of the oxide dispersion on recrystallization was the basic aim of the investigation.

Extrusions of about 0.1-in. diameter were produced at 1000°F from the 2S, AT-400, and MD 2100 alloys. They were cold-worked to various degrees by drawing, and wire segments were subjected to isothermal anneals. The isothermal recrystallization behavior of the alloys was determined by photomicrographic examination of the transverse sample sections, using an anodized-film, polarized-light technique.

Activation energies for the overall recrystallization process were determined for the alloys; these were found to be somewhat temperature dependent, and invariably increased with oxide content. The activation energy for recrystallization was about 55,000 cal/mol in the 2S alloy; about 90,000 cal/mol in the AT-400 alloy; and about 170,000 cal/mol in the MD 2100 alloy.

The macroscopic mode of recrystallization of the powder products differed from that of 2S aluminum. Whereas the 2S alloy recrystallized by the preferential formation of very numerous small nuclei first in the region midway between the center and surface of a wire, followed by nucleation and growth in the central wire regions, in the AT-400 alloy the preferred sites for nucleation lay at the wire center and surface. Below 800°F nucleation occurred only at the center, and recrystallization proceeded by radial growth of one or several

very large grains. At 850°F. and above, nucleation occurred preferentially at both the center and surface of a wire. In the MD 2100 alloy nucleation occurred only in the central wire regions at all temperatures.

The activation energy for nucleation in the AT-400 alloy was about 110,000 cal/mol; the activation energy for radial nucleus growth was about 95,000 cal/mol. These data are consistent with the observation that the transverse recrystallized grain size decreases with increasing temperature of recrystallization.

Auxiliary studies were undertaken in an attempt to explain the recrystallization behavior of the alloys. Micro-hardness surveys on transverse sections of cold-drawn wires indicated a fundamental difference in work-hardening characteristics of the alloys. The 2S alloy wires were hardest at a point midway between their centers and surfaces, whereas the powder product wires were hardest at their centers.

X-ray studies revealed a zonal texture in the cold-drawn wires of each alloy. The texture of a 2S alloy wire varied from a poorly defined [111] at the surface to a very sharp [100] at the center. The textures of the powder product wires varied from a poorly defined [111] at the surface to a well defined [111] + 3 per cent [100] at the center.

The recrystallization texture of center-nucleating grains in AT-400, as determined by individual Laue patterns, was fairly well defined. The texture could best be described as a preferential orientation of [320] directions of the recrystallized grains parallel to the wire axes.

The possible effects of residual stresses on the recrystallization behavior of the powder products is discussed. Microfilm $2.50; Xerox $8.60. 189 pages.

ENGINEERING, SANITARY AND MUNICIPAL

A LABORATORY STUDY OF THE EFFECTS OF DRAINAGE AND TRANSPIRATION ON DIGESTED SLUDGE LAGOON DEWATERING RATES.

(L. C. Card No. Mic 59-3799)

Edgar Allen Jeffrey, Ph.D.
State University of Iowa, 1959

Chairman: Professor Philip F. Morgan

This laboratory study was initiated with the purpose of determining design figures to be used in the rational design of digested sludge lagoons. The factors investigated were:

1) The rate at which the sludge dewaters.
2) The effect of sludge-sand interface clogging and the resistance of previously deposited sludge layers on dewatering rates.
3) The effect of sludge depths on dewatering rates, and
4) The effect of evapotranspiration on the moisture removed from sludge at various depths.

Each of these factors represents one phase of the study.

The variables involved in the study were sludge depth, supporting material, and dewatering forces applied (drainage, evaporation, and transpiration). The laboratory lagoons used in each phase were essentially the same but with some variation in diameter and depth. The first factor listed above was investigated in "Drainometers" which are standard laboratory sand beds developed for this study. Interface clogging and resistance to flow through the previously deposited sludge layers was investigated by measuring the head loss at the interface and the pressure gradient along the sludge columns of various depths. The effect of evapotranspiration was determined by measuring the moisture removed by tomato plant growth over a 3 month period.

The conclusions drawn in each phase of the study are correlated in the final chapter and the application of results is illustrated in an example design problem. Results obtained by previous investigators are summarized in the first chapter, and those applicable to lagoon design are superimposed on the results obtained in this study.

Based on the results obtained in this and previous studies, the recommended lagoon operating procedure involves a 3 year cycle. The lagoon is loaded for a year, allowed to dry for 18 months, cleaned, and then the supporting material is "rested" for 6 months. This requires the use of 3 lagoons and provides ample operating flexibility. Microfilm $2.00; Xerox $6.00. 124 pages.

A STREAM SURVEY IN THE URANIUM MINING AND MILLING AREA OF THE COLORADO PLATEAU.

(L. C. Card No. Mic 59-3894)

James Markus Morgan, Jr., D.Eng.
The Johns Hopkins University, 1959

The effect of the discharge of liquid wastes on the environment from uranium milling operations on the western slope of the Rocky Mountains in Colorado was investigated. Approximately three hundred river miles on the Colorado and Gunnison Rivers were investigated. Water, mud and algae samples were collected; the samples were analyzed chemically, physically and radiologically. Aquatic organisms were identified and coliform densities of river waters were determined.

Microfilm $4.55; Xerox $15.20. 354 pages.

GIOVANNI ANTONIO BOLTRAFFIO— A STYLISTIC STUDY OF HIS WORK.

(L. C. Card No. Mic 59-3462)

Rodman Robinson Henry, Ph.D.
Boston University Graduate School, 1959

Major Professor: Associate Professor George Levitine

The research and compilation of material for this dissertation represents a preliminary study which allows for additions and reattributions in the future if necessary. It was written because of the author's interest in the Milanese School of the Renaissance and the necessity for a comprehensive study of the life and works of the artist. Research was not confined merely to the life and works of the artist, but a thorough investigation was pursued into the life, writings, and artistic productions of his teacher, Leonardo da Vinci, as well as other Milanese artists and painters of the period. This was necessary in order that a more definitive and reasonable conclusion might be reached. Research was carried on in the customary fashion utilizing all libraries, museums, and institutions both in this country and in Europe in order to obtain all available information although documentation of a concrete nature could not be found in any quantity.

Nevertheless, the limited records had to suffice in order to establish the sparsely documented life of Giovanni Antonio Boltraffio (1467-1516). The most helpful source was the writings of Leonardo da Vinci in which he recorded from time to time the activities of his pupils. There is also remaining to this day Boltraffio's mortuary stone and the existence of a dated commission, 1502. Other primary sources which can be considered pertinent in this instance were public documents, and the writings of Giorgio Vasari, Abate Luigi Lanzi, and A. Betti. The remaining material was secondary in nature and had to be scrutinized closely before its utilization was possible. Due to the fact that very little documentation remains little attention has been given Boltraffio, and as a result he has been relegated to a somewhat obscure position in the annals of art history.

Throughout the dissertation conclusions were drawn objectively and with established and proven works by Boltraffio an analysis was made of his style, technique and iconography in order that a style could be established to which other works might be attributed. The stylistic analysis would not have been complete had not one been done for each of the other Milanese artists of the period so as to distinguish Boltraffio from them. The study is concluded with a catalogue raisonné assigning to Boltraffio two chalk and pastel drawings, thirty-eight paintings, and five paintings questioned or in part by the artist.

The greater portion of the text deals with the examination, analysis, and attribution of individual paintings, and suggests a possible date for the execution of each. Attention was also given to the life of Boltraffio, his family and background, those with whom he associated, a suggestion as to his early teachers, and a hypothetical assertion concerning his character as revealed by his work. His artistic career has been divided into two parts: that which existed prior to 1500, and that which followed.

Boltraffio followed the teachings of Leonardo da Vinci, but seldom lost his individuality of style or technique. Boltraffio's independence of style is readily distinguishable from the other artists', of whom the greater majority possess more adequate documentation making the recognition and separation of his artistic works considerably less arduous. Distinguishing himself by being more independent, selective, perceptive, and original in his interpretation of meaning and character, Boltraffio advances his artistic productions to a higher and more discernable level of understanding and stylistic individuality.

Microfilm $5.15; Xerox $18.20.. 403 pages.

THE CARMONA DYNASTY (VOLUMES I - III).

(Publication No. 22,957)

Eileen Angelin Lord, Ph.D.
New York University, 1954

Adviser: Dr. José López-Rey

The Carmona Dynasty is a study of the art of the members of this Spanish family who were: Luis Salvador Carmona, sculptor (1708-1767), José Salvador Carmona, sculptor (1712-before 1800), Manuel Salvador Carmona, engraver (1734-1820) and Juan Antonio Salvador Carmona, engraver (1740-1805?).

Investigation revealed that little factual knowledge of their work had been published. Luis and José Salvador Carmona's sole biographer was Ceán Bermúdez who in 1800 published Diccionario histórico de los maś ilustres profesores de las bellas artes en España in which he partially listed works, identifying a few and indicating the location of others. Manuel's contribution was discussed in Carderera's 1862 article in the magazine, El arte en España. Juan Antonio was chronicled briefly in the Conde de la Viñaza's 1889 Adiciones al diccionario histórico de los más ilustres profesores de las bellas artes en España de D. Juan Augustín Ceán Bermúdez. The two most able Carmonas, Luis and Manuel, have enjoyed frequent mentions in critical publications of a comprehensive nature, but these have been unfailingly predicated upon the above sources and have offered nothing new. Nor did the original publications provide an adequate basis for an evaluation of their work. In 1932 and 1947 the Archivo español de arte y arqueología published, without critical comment, isolated documents concerning Luis and Manuel respectively.

The present study reveals unpublished documents that establish the authenticity of some past attributions, prove the error of others, verify new assignations and provide

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

biographical data previously unknown. These documents also make possible the understanding of the evolution of their artistic developments through the dates that may now be accepted for individual works. This last factor was a basis for a critical analysis of their total contribution and its relation to the contemporary artistic zeitgeist within Spain and beyond its borders in France, Germany and Italy.

A definitive catalogue of works accompanies the analysis of each of the artistic careers of the members of the Carmona family and offers a sound basis for future aesthetic judgments concerning the part played by Spanish artists during a period that has been largely neglected to date by art historians. However, future detailed research on the careers of the Carmonas' contemporaries is necessary to give a broader picture of Spanish art in their day.

Luis Salvador Carmona, who received the honors of Sculptor to the Spanish King and Lieutenant-Director of Sculpture in the San Fernando Academy, created the major part of his works in polychromed wood. Parallels to Carmona's style may be found in France in the works of Jean Baptiste Lemoyne (1704-1778) and his pupil, Etienne Maurice Falconet (1716-1791), and in Germany in the art of the two Munich School contemporaries, Joachim Dietrich (act. 1736-1753) and Johann Baptist Straub (1704-1784). Despite this similarity of style, Carmona might very well have evolved his art from influences wholly within Spain. He had a legacy of naturalism fraught with emotional expression in the works of Álonzo Berruguete (1490-1561), Juan de Juní (1507-1577), Gregorio Fernandez (1566?-1636) and Pedro de Mena (1628-1688). From Manuel Pereyra (act. 1646-1667) he could have gleaned an appreciation of suave elegance of proportions and mannered pose. Pedro Duque Cornejo (1677-1757) may have personally revealed to him the delicious excitements of rippling movements and capricious effects. From his teacher, Juan Ron (act. 1700-1730), he must have learned to observe detail and to cherish its infinite variety.

José Salvador Carmona (1712-before 1800) holds little significance in Spain's artistic development. He was, at best, an imitator of his uncle, whose superior talent completely escaped him. The present investigation serves to clear up some otherwise puzzling attributions to Luis.

Manuel and Juan Antonio entered their period of professional academic activities in engraving in the 1760's, when a wave of scientific interest in classical art rolled over Europe. Both had been trained in the earlier tradition, however, and while accepting the new precepts of measured restraint, they retained an admiration for a theatricality of style. Manuel, who of the two had the greater gift, became Engraver to the Kings of France and Spain, member of the French Académie Royale, as well as Director of Engraving in the San Fernando Academy, and honorary member of other academies in France, Spain and Italy. Juan Antonio was a member of the San Fernando Academy and before he died also became Engraver to the Spanish King.

Microfilm $9.70. Xerox $34.60. 767 pages. Mic 59-5015.

A SPECTROPHOTOMETRIC REFLECTANCE METHOD FOR DETERMINING THE CHEMICAL NATURE OF MYOGLOBIN PIGMENT IN FRESH BEEF.

(L. C. Card No. Mic 59-3571)

Robert Waters Dean, Ph.D.
Rutgers University, 1959

Major Professor: Dr. C. Olin Ball

Myoglobin is the pigment present in fresh meat which is responsible for its color. Depending on whether the pigment is largely in the met-, oxy-, or reduced-myoglobin form, the meat is respectively brown, light red, or purple red in color.

A method employing reflectance measurements of samples at four different wavelengths of light was developed for estimating the proportions of the three types of myoglobin pigment present on the surface of beef samples packaged in air, in oxygen, or under vacuum in packages permeable to air, semi-permeable to air and impermeable to air.

The method was based on the principle expounded by Broumand et al (10) and applied in a procedure employing absorbancy measurements.

The reflectance ratio method indicated that reduced myoglobin is the predominant pigment of vacuum packaged beef.

For beef samples vacuum packaged in semi-permeable films the reduced pigment remained relatively stable while the proportion of oxy versus metmyoglobin present during storage appeared to determine the redness of the meat.

The fact that these samples exhibited a return in red color after an initial discoloration strongly suggests that under the conditions of the experiments, during storage, metmyoglobin is converted to oxymyoglobin. This denotes that the reaction which forms metmyoglobin in prepackaged beef is reversible, which is contrary to most published opinions.

The effect of oxygen in excess in prepackaged beef appeared to be that of causing the formation of metmyoglobin after several days in storage.

The effect of small quantities of oxygen (vacuum packaging) appeared to be that of producing oxymyoglobin after several days in storage.

For prepackaged beef in general, reduced myoglobin appeared to be present as a reservoir which could be converted to either oxymyoglobin or metmyoglobin and depending on conditions in the package could be produced from either pigment.

Microfilm $2.00; Xerox $6.20. 130 pages.

A MICROSCOPIC STUDY OF THE STRUCTURAL CHANGES OF PEACHES AND PEARS DURING SOFTENING.

(L. C. Card No. Mic 59-3601)

Chung Hyun Son, Ph.D.
Rutgers University, 1959

Major Professor: Roy E. Morse

Five varieties of peaches and two varieties of Bartlett pears were studied with light and electron microscopes to determine the structural changes of the fruits during tree ripening and storage softening. The five varieties of peaches included clingstone peaches of non-melting and melting flesh type, and freestone peaches of melting flesh type.

In the preparation of samples for electron microscopy a comparative study was made between freeze-drying and alcohol dehydration. Freeze-drying of the samples by immersion in liquid nitrogen followed by vacuum sublimation offered promise for preparing peach and pear samples for electron microscopy.

n-Butyl methacrylate, Bakelite epoxy resin, and CIBA Araldite were tried as embedding media of the fruit samples for electron microscopy. The comparative study showed the CIBA Araldite mixture to be superior.

The tissues and medium were evacuated to 25 microns of mercury during embedding in an attempt to remove any residual alcohol carried by the tissues and to improve tissue penetration. The cutting quality of the resulting cured tissue block was compared to that of the cured tissue block in which the tissue had been immersed in alphamethylbenzyl dimethylamine (accelerator) and the mixture of CIBA Araldite and dodecenyl succinic anhydride (hardener) prior to embedding. The sectioning quality of the latter was superior to that of the former.

The thickness of the flesh cell walls of fruits at different stages of softening was measured. An attempt was made to determine the cause of cell wall thinning during softening.

Electronmicrographs of the cell walls of softening fruits revealed that cohesion of cell wall microfibrils decreased as the fruits softened. Consequently the cell wall microfibrils separated from one another, and were finally broken into smaller pieces. The cell walls of non-melting flesh type peaches appeared to contain more densely packed microfibrils than those of the melting flesh type peaches.

Microfilm $2.00; Xerox $5.20. 102 pages.

GEOGRAPHY

CHANGING LAND-USE PATTERNS IN THE NIAGARA FRUIT BELT.

(L. C. Card No. Mic 59-4014)

Ralph Ray Krueger, Ph.D.
Indiana University, 1959

The Niagara Fruit Belt as delimited from Census data includes the following ten townships along the Lake Ontario shore of the Niagara Peninsula of Ontario: Barton, Saltfleet, North Grimsby, Clinton, Louth, Grantham, Pelham, Thorold, and Stamford. A study of Niagara climate and soil characteristics indicates that the Niagara Fruit Belt is exceptionally well endowed for the growing of fruit, particularly the tender fruit crops such as peaches.

Census data for 1931 and 1951 are examined to show the changes in the uses of farmland and the growth of population in the different townships of the Fruit Belt. A more detailed analysis of changing land-use patterns is provided by a series of maps based upon data obtained from 1932 and 1954 air photos. These maps show in detail the patterns in 1954, and the pattern changes between 1934 and 1954 for the following: (i) orchards (ii) vineyards (iii) other arable land (v) non-arable land (v) built-up area.

The two most significant changes in land use are the change from general farming to fruit growing, and the urban expansion which is threatening the fruit growing industry.

Because the areas in Canada which can produce tender fruit crops are extremely limited; because the Niagara Fruit Belt is conveniently located adjacent to a large and growing urban market; and because the tender fruit crops can be grown only on the light textured tender fruit soil, while urban land uses can expand with little difficulty on almost any type of soil; the conclusion is reached that the fruitland with tender fruit soil should be preserved for fruit production. This is feasible in the Niagara Fruit Belt because there are large areas adjacent to the cities and towns, and conveniently located for urban development, which do not have the required soil conditions for tender fruit crops. Thus, if urban growth is properly controlled and directed on a regional basis, the choice fruitland can be preserved without curtailing industrial and urban development. The Province of Ontario appears to have the necessary legislation to carry out the planning which is required. Microfilm $2.80; Xerox $9.60. 214 pages.

ADVANCING AND RETREATING FRONTIERS OF AGRICULTURAL SETTLEMENT IN THE GREAT CLAY BELT OF ONTARIO AND QUEBEC.

(L. C. Card No. Mic 59-3205)

George Louis McDermott, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Kirk H. Stone

The Great Clay Belt of Cochrane County, Ontario and Abitibi County, Quebec, the largest area of sparsely settled, potentially arable land in Eastern Canada, has undergone differential growth in its two political segments during

the quarter-century from 1931 to 1956. During this period, the farm population, number of farms, amount of land in farms and the amount of improved land in farms have increased rapidly in Abitibi and decreased in Cochrane. This dissertation is concerned with the following questions: Where and why is the Clay Belt frontier advancing? Where and why is the Clay Belt frontier retreating? The Great Clay Belt affords a particularly good opportunity, in the analysis of the causation of advance and retreat of the frontier, to make a comparison between the two physically homogeneous, political segments. Settlement in Cochrane has been unplanned, individually financed and is dispersed. In contrast, settlement in Abitibi has been carefully planned, supervised, financed by the provincial government and is agglomerated.

Extensive field investigation has revealed that the retreating frontier in Cochrane and the advancing frontier in Abitibi occupy similar positions in that both are removed from the main east-west highway and railroad and are on the fringes of older or more stable areas. The main direction of advance now is northward. The areas of advance are much larger than the areas of retreat. Both climate and soils improve from east to west within the region, hence the advance of the frontier in Abitibi has been against greater physical handicaps.

The contrast in settlement between Cochrane and Abitibi is due basically to differences in attitude of the respective provincial governments toward the development of their northern most agricultural frontier. Ontario's quasi laissez-faire settlement policy has led to the settler's employment of trial and error methods characteristic of the frontier a century ago. The lack of encouragement from the government, the lack of pre-settlement planning and the low economic return from the bush farm have contributed to widespread land abandonment and the retreat of the frontier in Cochrane. Quebec has taken a more paternalistic approach to settlement by aiding the settler in every possible way through the application of rational principles to settlement planning, and the willingness to spend any necessary amount of money, with the result that the developed area of Abitibi has more than doubled in the last quarter of a century.

Microfilm $2.35; Xerox $8.20. 179 pages.

THE DISTRIBUTION OF POPULATION IN COSTA RICA.

(L. C. Card No. Mic 59-3949)

Robert Edward Nunley, Ph.D.
University of Michigan, 1959

The purpose of this study is twofold: (1) to present a detailed map of the present distribution of population and a series of generalized maps of past distribution and (2) to analyze the patterns of population both historically and regionally to see why population should be distributed as it is.

The detailed map shows the relative size of the various villages, towns, and cities, as well as the density of rural populations; it also shows the limits of the area which contributes to the economy of Costa Rica. The former were based on the distribution of houses plotted from census maps, aerial photographs, and field observations, and ascertained by using an average of five persons per house; the latter were based on land use maps, aerial photographs, and field observation and were derived by including all areas which showed evidence of houses, roads, fields, or other human effects. A geographic structure of population, made up of centers, lines, and limits of population, stands out as the basic pattern of distribution and, so, serves as the basis of study. A series of historical maps, compiled from older censuses and historical documents, show how the structure of population evolved.

In Chapter III, the evolution of the centers, lines, and limits of population is analyzed and described. Facts of cultural and physical geography are brought in where needed to explain facts of population.

In Chapter IV, the present distribution is divided in six regions with two or more districts in each. As in Chapter III, an attempt is made to see how the centers, lines, and limits of population have influenced the development of each other and how they have been influenced by other facts of the cultural, as well as facts of the physical environment.

Many intricate interrelations are encountered. However, in simplest terms the expansion of the area used by man, depends upon the development of cities and towns, which, in turn, depends upon the development of roads.

Microfilm $2.00; Xerox $6.00. 124 pages.

LIMA, PERU: A STUDY IN URBAN GEOGRAPHY.

(L. C. Card No. Mic 59-3957)

Joseph Treble Sinclair, Ph.D.
University of Michigan, 1959

This dissertation is a study of the distribution patterns that make up Lima, and an attempt to explain their present forms in terms of the history and functions of the city.

Lima was founded by the Spanish for the purposes of economic and military control of western South America at a location important to them because of its advantages for seaborne commerce. The site had been little used by the Indians, but had many desirable qualities for a metropolis. The basic pattern on which Lima developed was common to many Spanish colonial cities: rectangular blocks around a central plaza with radiating avenues reaching out toward the surrounding countryside. The original city, which is now the district of Lima and includes the principal commercial area, was loosely built with many gardens and orchards in it. For many years the growing population was accommodated by increasing the density rather than the area of the city, and only a few suburban towns grew up around it. The port of Callao, economically a part of the commercial entity, has had a separate existence and is only incidentally included in this study.

The colonial period established, within the main part of the city, the pattern of structures that come from such functions as government, education, culture, and recreation, in addition to those of a commercial nature.

The modern growth of Lima, started after Peruvian independence in 1821, was brought about by the industrial revolution and the spread of urbanism over the Western World. The last century has brought a great increase in population, including Lima's large middle class. The city

expanded along the radiating avenues, reaching and annexing suburban towns. From these annexations and administrative subdivisions of the older city the political pattern developed.

The present pattern of functional land-use is composed of the distributions of several kinds of structures. The three classes of residential areas--upper, middle, and lower--may be explained by a combination of colonial prestige, industrial and commercial expansion, and modern construction. The industrial areas are localized by transportation and by early and wise zoning. The commercial core is centered on the old colonial city, but subsidiary commercial nodes are scattered throughout the metropolitan area. The separate distributions of educational and religious structures, parks, public buildings, hospitals, and clinics among others make patterns explainable in terms of their individual function and history but do not allow generalization.

The present city of Lima derives its form and character from its general function as the point of penetration of the modern world into Peru; there is little within the city which can be attributed to the native life.

In conclusion, the dissertation predicts that the recent growth of the city will continue because of the population movement to it resulting from government spending and industrial development; that its world position is stable in terms of government and political status; and that its function as a focus of South American culture based on its history is waning.

Microfilm $2.40; Xerox $8.40. 182 pages.

GEOLOGY

HYDRODYNAMICS AND GEOCHEMISTRY OF THE JURASSIC AND CRETACEOUS SYSTEMS IN THE SAN JUAN BASIN, NORTHWESTERN NEW MEXICO AND SOUTHWESTERN COLORADO.

(L. C. Card No. Mic 59-3682)

Frederick Almet Fulghum Berry, Ph.D.
Stanford University, 1959

The San Juan Basin is a structural basin formed during the Laramide orogeny. The basin is characterized by an Inner Basin surrounded on all but the south side by steeply dipping monoclines. Platform areas exist outside the monoclines. The basin has a thick Jurassic and Cretaceous section. The Entrada sandstone and related stratigraphic units of Jurassic age form a unit with high transmissibility. The Todilto limestone is present within this transmissibility unit and has an evaporitic facies developed over the eastern third of the basin. The evaporitic facies is dominantly anhydrite but with an estimated ten percent sodium chloride content. The Cretaceous section consists of transgressive and regressive deposits and is characterized by sand units of very low transmissibility separated by shale sections. Intertonguing of various facies types occurs on a large scale: marine shale; shore line sand deposits; lagoonal coals, silts, shales, and sands; and flood plain silts, shales, and sands. The lowest Cretaceous aquifer, the Dakota sandstone, is separated from the high transmissibility unit of the Entrada and related stratigraphic units by the Brushy Basin claystone member of the Morrison formation.

Slopes exist on the potentiometric surfaces of all of the Jurassic and Cretaceous aquifers and thus, by definition, hydrodynamic conditions exist. This condition in all of the Cretaceous aquifers is characterized by flow directed, in general, towards the lowest outcrop outlets dominantly to the northwest, but with flow directed "basinwards" in and around the Inner Basin. Potentiometric surface divides ("pressure anticlines") exist on each of the Cretaceous potentiometric surfaces on the west side of the Inner Basin. This anomalous configuration means that water is being lost hydrodynamically from each of these aquifers within the Inner Basin. Absolute potentiometric surface elevations fall below the lowest outcrop elevation for any particular Cretaceous aquifer within the Inner Basin. The salinities of the waters in the Cretaceous aquifers are quite fresh around the margins of the basin--generally less than 5,000 to 10,000 ppm. However, the salinities of the waters from these same aquifers increases sharply--from 50,000 to 70,000 ppm--coincident with anomalous potentiometric surface "sinks" in and around the Inner Basin.

Any theory to explain these facts must account for the anomalously low potentiometric surface "sinks", the coincident sharp increase in the salinities of the formational waters, the position where these relationships occur; i.e., in and around the Inner Basin, and the fact that these relationships occur in all of the Cretaceous aquifers.

It is believed that two types of hydrodynamic systems exist--one system being due to gravitational flow (difference in elevation between inlet andoutlet areas) and the other due to osmotic flow (salinity differences in two aquifers separated by a shale bed serving as a semi-permeable membrane). It is postulated that gravitational hydrodynamic flow originated in early Miocene time directed towards the regional outlet of the basin to the northwest. It is believed that highly saline waters--130,000 to 270,000 ppm--entered the Entrada and related stratigraphic units from solution of the evaporitic facies of the Todilto. It is believed that these saline waters--moving to the west hydrodynamically--were trapped within the Inner Basin due to hydrodynamic tilt relationships between denser water in the bottom of a steeply dipping syncline and lighter waters (fresher) surrounding the syncline. Osmotic pressures are believed to have been established between these saline waters and the fresh waters of the Dakota via the intervening Brushy Basin claystone serving as a semi-permeable membrane. The Dakota potentiometric surface was drawn down thereby and the residual waters in the Dakota became concentrated due to ion-exclusion. These conditions, in turn, established hydrodynamic and osmotic drawdown effects on the overlying Gallup sandstone and

sands of the Mesaverde group (Restricted) via the intervening Mancos shale. In turn, these potentiometric surfaces were drawn down and the residual waters concentrated with resultant drawdown and concentrating effects on the overlying Pictured Cliffs sandstone via the intervening Lewis shale. The potentiometric surfaces are drawn down less progressively upwards through the section, as should happen in such a system.

This postulated osmotic system represents a transient energy state as salt water is being lost from the "salt core" of the Entrada and related stratigraphic units in an amount at least equal to the total amount of dilute water entering the "core" osmotically. It is believed that the evaporite facies could have supported the existence of this "saline core" and thus the osmotic system for the 20 million years since early Miocene time, and that it might support this osmotic system for an additional 5 million years.

Osmosis is believed to exist with shales acting as semi-permeable membranes with consequent ion-exclusion effects due to electric charge relationships. The Donnan Equilibrium and streaming potential are believed to control the degree of ion-exclusion.

Microfilm $5.95; Xerox $20.80. 466 pages.

THE GEOLOGY OF THE SKOWHEGAN QUADRANGLE, MAINE.

(L. C. Card No. Mic 59-3451)

Harold William Borns, Jr., Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor C. Wroe Wolfe

The Skowhegan quadrangle includes approximately 215 square miles of Somerset County in central Maine.

This geological study includes sedimentary, igneous, and metamorphic petrology, stratigraphy, structure, and geomorphology.

The metasedimentary rocks that comprise most of the quadrangle are impure quartizites, black, gray, or green phyllites and slates, and some impure limestones.

The stratigraphy includes three major units. The oldest, Unit 1, consists of poorly sorted argillaceous sandstones and quartizites interbedded with thin layers of phyllites and narrow pebble conglomeratic layers. Both siderite and sulfide are common in Unit 1.

Unit 2 consists of impure quartizites interbedded with slates and phyllites, impure limestones, and occasional pebble conglomeratic layers. All rock types contain considerable amounts of sulfide, while in some zones minor amounts of calcite and siderite are contained in the quartzites.

Unit 3, the youngest, consists of calcareous quartzites interbedded with thin zones of phyllites and slates. Little or no sulfide is present in this unit.

Unit 3 is tentatively correlated with the fossiliferous Vassalboro Formation of Middle Silurian age in the Waterville quadrangle, while Units 1 and 2 are considered to be pre-Middle Silurian.

The Hartland Granite body, a discordant pluton located in the central eastern portion of the quadrangle, has been dated by the potassium/argon method as lower Middle Devonian. The intrusion of the pluton is related to the folding.

The metamorphic halo about the Hartland Granite is distinct and can be divided into two zones. In the argillaceous rocks, the innermost zone is characterized by an actinolite-zoisite assemblage, while the outer zone is characterized by a biotite-chlorite assemblage. Regional metamorphism has not been recognized in the quadrangle.

The sediments were deformed by compressive stresses trending approximately NW-SE. Deformation resulted in bedding attitudes that strike approximately NE-SW and dip vertically or nearly vertically. The beds show a repetition that can provisionally be interpreted from the viewpoint of isoclinal folding. However, many of the characteristics of classic isoclinal folds are absent. Therefore, the Pleated Fold theory is suggested as a possible alternative mechanism of deformation.

The topography of the quadrangle is primarily the result of stream erosion, controlled by the lithology and geologic structure of the area. Secondarily, the pre-glacial topography formed by running water has been slightly modified by continental glaciation.

The relative geomorphic competency of rock types can be seen in an investigation of the pre-glacial stream pattern. In the area of the Hartland Granite pluton and its associated metamorphic halo the topography is primarily controlled by the rock types rather than the structure. The granite is less competent than the immediately adjacent hornfels rim and forms a basinal area, while the latter forms a marginal ridge.

There is evidence for only one glacial advance in this quadrangle and this is presumed to be that of the Wisconsin Stage.

The ice, moving generally towards the southeast, slightly modified the pre-glacial topography. As the ice waned, ice contact deposits were formed, and a large pro-glacial lake developed and occupied the area of the town of Skowhegan and the valley of the Kennebec River within this quadrangle. This lake was partially or completely filled with sediments being derived from the retreating ice. In early post-glacial time the lake drained and its sediments were incised by the superimposed early post-glacial Kennebec River. The incision produced a series of cut terraces, in the Skowhegan plain and along the valley of the Kennebec River in the region, the levels of which were controlled by local or regional base levels. The lake sediments are probably contemporaneous with the post-glacial marine clays of the Waterville quadrangle.

Microfilm $3.25; Xerox $11.20. 251 pages.

GEOLOGY AND GENESIS OF THE LEPANTO COPPER DEPOSIT, MANKAYAN, MOUNTAIN PROVINCE, PHILIPPINES.

(L. C. Card No. Mic 59-3703)

Arsenio Geronimo Gonzalez, Ph.D.
Stanford University, 1959

The deposit is on the eastern limb of a broad anticline with a north-south axis. At the core of the anticline is an intrusive mass of Trondjemite (Bagon intrusive).

Immediately east of the Bagon mass is the Lepanto metavolcanics, the oldest rocks in the area. Flanking the metavolcanics farther east is a thick sequence of sedimentary rocks (Balili beds). Erosion during Miocene time cut deeply along the axis of the area and exposed the underlying rocks. A late Tertiary pyroclastic (Capping) of predominantly dacitic composition forms a flat blanket over the older rocks. The known copper mineralization is in a silicified zone in the metavolcanics, although minor silicification and mineralization extend into the Capping.

The Lepanto ore body consists of one mineralized zone and many split veins that break off from the zone at an acute angle. The main ore body is a pipe-like deposit with a strike of North 55° West and a pitch of about 5° to the Southeast. It is roughly triangular in cross-section, widest near the metavolcanics-Capping contact and narrowing downward. Maximum widths vary from a few meters to several tens of meters. The splits are closely spaced narrow veins that break off from the main zone and strike East-West. Most of them pinch out within a few meters from the main ore body, but a few extend as much as a hundred meters away. Mineralization in both the main ore body and the splits dies out about 60 meters below the Capping and seldom penetrates more than a few meters into that rock. A post-mineral fault has sliced the main ore body longitudinally, and displaced the two parts an apparent vertical distance of 50 meters.

In the main ore body the copper minerals occur partly as replacement and partly as breccia filling of the fractured silicified rock. In the splits, the copper mineralization is mainly open fissure filling. The principal copper minerals are enargite and luzonite. In lesser amounts are tennantite, chalcopyrite, and sooty chalcocite. Most of the gold and silver occur as native alloys and as fine-grained tellurides. Part of the gold may be in pyrite, and some of the silver in tennantite. Other sulphides are pyrite and sphalerite. The main gangue mineral is quartz. Kaolin and barite are in minor amounts.

Paragenetic relations of the ore minerals, and other characteristics of the ore body suggest the following sequence in its deposition.

1. Broad silicification along a northwesterly fracture.
2. Refracturing of the silicified zone. Movement along surface now marked by breccia ore.
3. Mineralization which is characterized by the deposition of enargite and luzonite in the early stages, and tennantite, gold and silver minerals, and chalcopyrite later.
4. Movement along the present fault surface, which sliced the main ore body.

The nature of the ore and its mineralogy suggest deposition in a shallow or low pressure environment at a temperature ranging from 275 C to 350 C. Horizontal zoning shown by (a) variation in mineralogy, (b) variation in silver-gold ratio, and (c) change in the amount of tin in enargite and luzonite, indicate a southeast source of the mineralizing fluids. Evidence points to an acid ore solution at least in the early stages.

Three factors are believed to have controlled the localization of the ores in Lepanto. They are: (a) preliminary silicification which serves as ground preparation, (b) post-silicification fracturing to furnish the passageway for the ore solution, and the openings for ore deposition, and (c) an impermeable cap rock which prevented the ore solution from dissipating upward. The ore solution is believed to have moved almost horizontally through the brecciated zone from its source in the southeast to the northwest end of the mineralization.

Microfilm $2.00; Xerox $6.00. 122 pages.

PETROLOGY OF THE ALLARD LAKE ANORTHOSITE SUITE, AND PAŁEOMAGNETISM OF THE ILMENITE DEPOSITS.

(L. C. Card No. Mic 59-4412)

Robert Bero Hargraves, Ph.D.
Princeton University, 1959

PARTS I AND II

Ilmenite deposits occur in anorthosite in the vicinity of Allard Lake, about 25 miles north of Havre St. Pierre (Que.) on the north shore of the St. Lawrence river. Three main rock types are exposed in the 30-square-mile area examined, which straddles the northeast border of the anorthosite massif.

1. Coarse grained, massive anorthosite, generally consisting of more than 95% calcic andesine; in thin-section displaying considerable evidence of cataclasis. Locally the anorthosite contains large plagioclase phenocrysts of similar composition to the matrix plagioclase. Irregularly distributed bronzite occurs as interstitial frameworks, poikilitically enclosing plagioclase, as roughly aligned aggregates of coarse crystals, and as coarse crystals along joint surfaces which transgress primary foliation in the anorthosite.

2. Medium grained, gneissoid, oxide-rich norite, consisting (in paragenetic order) of 3 to 50% protoclastically deformed plagioclase (An_{40-45}) 0 to 40% pyroxenes (hypersthene > augite), 8 to 10% apatite, 20 to 54% oxides (hemo-ilmenite > magnetite).

This rock occurs in three moderate to steeply dipping sheets, as much as 4 miles long and 3000 feet thick, intruded into the anorthosite.

The composition and deformed nature of the plagioclase suggests that the norite resulted from the incorporation of crushed anorthosite by an oxide-pyroxene-apatite magma. An irregular antipathetic relation between the amount of pyroxene and oxide in individual samples, is unrelated to the position of the samples in the norite sheets. It is interpreted as resulting from immiscibility between the oxide and silicate fractions of this mafic liquid.

There is an enrichment in hemo-ilmenite toward the base of two sheets. Expulsion of a residual oxide-liquid by filter pressing, and its injection into the surrounding anorthosite, is believed to be the origin of the hemo-ilmenite ore deposits, which do usually occur in anorthosite below oxide-rich norite sheets.

3. Pyroxene syenite gneiss bordering the anorthosite massif. The contact zone is characterized by conformable gneissosity and enrichment in mafics in both the anorthosite and the syenite, and a progressive change in mineral composition toward the syenite.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Similar conformably zonal relations between anorthosite and bordering syenites or pyroxene granites are evident in published descriptions of other anorthosite massifs.

It is postulated that the anorthosite suite originated by intrusion of a hydrous gabbroic anorthosite magma into a catazonal environment in which the predominant country rocks were salic gneisses. Crystallization of the anorthosite resulted primarily from slow outward diffusion of volatiles whereby the bulk of the mafic constituents were concentrated towards the margin. Addition of volatiles to the country rock facilitated its partial fusion to a granitic magma which reacted metasomatically with the anorthosite to produce the pyroxene syenite gneiss.

PART III

The anisotropism of magnetic susceptibility of nearly pure hemo-ilmenite ore from deposits in the Allard Lake area, consists of a distinct plane of maximum susceptibility, with a minimum susceptibility axis at right angles. This plane coincides with a preferred crystallographic grain-orientation indicated by the parallelism of titan-hematite lamellae which have exsolved on the basal plane of the ferrian-ilmenite host grains. Measurement of the Remanent Magnetism (R.M.) shows a striking tendency for the R.M. vectors to lie in or near this preferred plane. On the assumption that hematite (if not ilmenite as well), is potentially ferromagnetic in the basal plane only, (paramagnetic parallel to the c-axis) it was inferred that the R.M. vectors could represent the resolved component of the magnetizing field which tended to lie in the plane of maximum susceptibility. Utilizing this principle, it is possible to resolve the broad spread shown by the R.M. vectors of samples from one deposit in terms of a single magnetizing field direction. The variation of the intensity of R.M. of otherwise similar samples can also be explained on this basis.

With one exception, the R.M. of 47 measured samples of hemo-ilmenite ore was reversely polarized (N seeking pole up). Additional natural history evidence bearing on the problem of self-reversal of Thermo Remanent Magnetism (T.R.N.) is provided by this study.

Microfilm $2.55; Xerox $8.80. 193 pages.

THE DIFFERENTIAL THERMAL ANALYSIS OF CERTAIN HYDRATED SUBSTANCES

(L. C. Card No. Mic 59-3463)

Richard Parker Hight, Ph.D.
Boston University Graduate School, 1959

Major Professor: Dr. Caleb Wroe Wolfe

This thesis is a differential thermal analysis study of certain hydrated minerals and chemical precipitates. These analyses indicate that the approximate peak temperature of the endothermic reaction which results in the loss of water of crystallization is 120° C.. The peak temperature for acid and basic water is about 490° C.. The peak temperature for acid is somewhat higher than for basic water. The energy involved in the removal of water of crystallization is somewhat less than that of acid and basic water.

Minerals containing zeolitic water release this type of water at relatively low temperatures and over a wide range of temperatures with no well defined peak temperature. The energy involved in this endothermic reaction is comparatively small.

In some differential thermal runs of minerals containing water of crystallization, two reaction peaks are observed, both within the range expectable for water of crystallization. These are due to the removal of octahedrally coordinated water in two stages. The first, and lower temperature stage, removes two of the water molecules at apices of the octahedron. The second and higher temperature stage, removes the other four water molecules at the equator of the octahedron.

By differential thermal analysis, it is sometimes possible to identify the type of water present in a water-bearing mineral as (a) water of crystallization, (b) acid or basic water, or (c) zeolitic water.

DTA runs of the following substances are presented:

$AlO(OH)$ Diaspore	$CaBSiO_4$ Datolite
$Al(OH)_3$ Gibbsite	$Ca(H_2PO_4)_2 \cdot H_2O$
$BaCl_2 \cdot 2H_2O$	$(Ca,Na,K)_3Al_5(Al,Si)Si_{14}O_{40} \cdot 15H_2O$ Stilbite
$Ca_2Al_3(SiO_4)_3(OH)$ Zoisite	$(Ca,Na,K)_6Al_{10}(Al,Si)Si_{29}O_{80} \cdot 25H_2O$ Heulandite
$Ca_2Al_2Si_3O_{10}(OH)_2$ Prenhite	$(Ca,Na,K)_7Al_{12}(Al,Si)Si_{26}O_{80} \cdot 40H_2O$
$Ca_2(Al,Fe)_3(SiO_4)_3(OH)$ Epidote	$CaSO_4 \cdot 2H_2O$ Gypsum
$Ca_{10}Al_4(Mg,Fe)_2Si_9O_{34}(OH)_4$ Vesuvianite	$Cu_3(CO_3)_2(OH)_2$ Azurite
$Ca_2B_6O_{11} \cdot 5H_2O$ Colemanite	$CuCl_2 \cdot 2H_2O$
$CuSiO_3 \cdot 2H_2O$ Chrysocolla	$Na_2Al_2Si_3O_{10} \cdot 2H_2O$ Natrolite
$FeAl_5Si_2O_{12}(OH)$ Staurolite	$Na_2B_4O_7 \cdot 10H_2O$
$FeO(OH)$ Goethite	$NaCaB_5O_9 \cdot 8H_2O$ Ulexite
$Fe_3(PO_4)_2 \cdot 8H_2O$ Vivianite	$NaHCO_3$
$KAl_3(OH)_6(SO_4)_2$ Alunite	$Na_2HPO_4 \cdot 7H_2O$
$KHSO_4$	$NiSO_4 \cdot 6H_2O$
$MgAl_2(OH)_2(PO_4)_2$ Lazulite	$(NH_4)Al(SO_4)_2 \cdot 12H_2O$ Ammonia Alum
$MgCl_2 \cdot 6H_2O$	SiO_2 Quartz
$Mg(OH)_2$ Brucite	$WX_3B_3Al_3(Al,Si_2O_9)_3(O,OH,F)_4$ Tourmaline
$MgSO_4 \cdot 7H_2O$	$Zn_4Si_2O_7(OH)_2 \cdot H_2O$ Hemimorphite
$MgSO_4 \cdot nH_2O$	

Microfilm $2.00; Xerox $5.80. 119 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

THE MICROSCOPIC STUDY OF ORE MINERALS WITH TRANSMITTED NEAR-INFRARED RADIATION.

(L. C. Card No. Mic 59-3711)

Wolfgang Werner Ekkehardt Mahrholz, Ph.D.
Stanford University, 1959

The purpose of this investigation of ore minerals with transmitted near-infrared (wavelengths 8000 - 12,000 A) was to ascertain whether enough ore minerals are transparent to the infrared to permit the development of an identification method. The minerals were prepared in sections 0.03 mm thick, and were examined with a Leitz AM microscope equipped with an infrared image converter tube (1 P 25 and CV 148 tubes), permitting the direct observation of orthoscopic and conoscopic images produced by transmitted polarized near-infrared.

Krypton discharge tube and cesium vapor lamp were found to be insufficient for infrared microscope illumination. Various other sources of infrared radiation (carbon arc, tungsten filament lamps, prism monochromator) were tested photometrically. The most efficient source for both band spectrum and monochromatic infrared was the carbon arc with appropriate filters.

Infrared detection by phosphorography was tested in addition to the electronic infrared converters, but was found to be not applicable.

After photometric testing of the equipment to determine optimum conditions, thin sections were prepared of 31 opaque, 5 subtranslucent and 6 transparent ore minerals. The sections had polished entry and exit surfaces to minimize radiation losses by scattering. Only 6 (12.6%) of the opaque and subtranslucent minerals were found to be infrared transparent to translucent (tetrahedrite, molybdenite, gratonite, stibnite, bournonite, boulangerite). Twenty-two of this group are common ore minerals.

The fact that most of the ore minerals examined, proved to be opaque to infrared, showed that the method can only have limited usefulness as a technique of identification.

In addition, the lack of distinctive criteria perceptible in the infrared makes the optical distinction of mineral species impossible. Refractive indices cannot be estimated microscopically because the indices are extremely high (ranging from 2.5-4.0 plus) and embedding media with such high indices are not available. Comparison with other infrared transparent minerals is seldom possible because the necessary mineral associations are rare.

Direct observations of birefringence, pleochroism and optical orientation cannot be made because of the lack of color perception. Accurate interpretation of interference figures (including birefringence estimates) can be made only with monochromatic infrared, which is difficult to obtain in sufficient intensity. Interpretation of interference figures for many biaxial minerals is hampered by the fact that apparent axial angles are very much larger than the real axial angles, because of the high indices of refraction. For the ore minerals not investigated, high refractive indices can also be expected according to the rule of Gladstone and Dale. Optic axial angles above the values of 25^{0}-47^{0}, depending on the refractive indices, cannot be observed.

Variation in absorption between mineral species cannot be used as a quantitative criterion because absorption varies so markedly with uncontrollable differences in surface polish of the thin section, both within the same mineral species.

A polishing machine was designed to decrease the difficulties in preparing sections. The results were encouraging, but further studies of abrasives, operating speeds and lubricants are required. The results also indicated that standardization of polish for natural minerals and mineral assemblages appears unattainable.

Microfilm $2.75; Xerox $9.60. 212 pages.

FAUNA OF THE MANITOBA GROUP, FROM MANITOBA, CANADA.

(L. C. Card No. Mic 59-4019)

Helen Mary McCammon, Ph.D.
Indiana University, 1959

A faunal study of the Manitoba group in Manitoba, Canada indicates that the lower Dawson Bay formation is Middle Devonian and the upper Souris River formation is Upper Devonian. Faunal zonation of the two formations is proposed; the Dawson Bay and Souris River are each subdivided into four zones. Fauna from the Dawson Bay is shown to be unrelated to that in the underlying Winnipegosis and Elm Point formations. The Dawson Bay formation correlates closely with the Cedar Valley formation of Iowa, Illinois, and Minnesota and possibly with the Milwaukee dolomite of Wisconsin and the Williams Island formation of the James Bay lowland. The Souris Valley formation correlates closely with the Waterways formation of Alberta.

New species and varieties described from the Dawson Bay include: two stromatoporoids, Anostylostroma bailliei and Ferestromatopora convergens; six corals, Amplexiphyllum salinensis, Buschophyllum minutum, Tabulophyllum gallina, Favosites pachymuralis, Thomnopora dumosa var. tabulata, Coenites hadrus; one bryozoan Cyphotrypa whiteavesi; four brachiopods, Atrypa manitobensis, Atrypa snakensis, Spinatrypa mascula var. manitobensis, Cyrtina paucicostata; and one trilobite Proetus manitobensis.

Microfilm $2.55; Xerox $8.80. 194 pages.

CRETACEOUS GEOLOGY AND PETROLOGY OF THE UPPER MISSISSIPPI EMBAYMENT.

(L. C. Card No. Mic 59-3594)

Wayne Arthur Pryor, Ph.D.
Rutgers University, 1959

Major Professor: James H. C. Martens

The Cretaceous sediments in the Upper Mississippi Embayment are Late Cretaceous in age on the basis of faunal evidence. Subsurface mapping shows these sediments to be a wedge shaped body which thickens rapidly to the south. A lithofacies and percent marine beds map shows the Upper Cretaceous Series to have high sand-clay ratios and a non-marine phase to the north and low sand-clay ratios and a marine phase to the south. The isopach and lithofacies map of the McNairy Formation shows an elongate body of sediments trending from the north to the southwest with two southwest trending tongues of high sand-clay ratios.

The McNairy Formation is composed chiefly of first cycle orthoquartzitic sands with compositions, of 1) quartz, 76 to 88 percent; 2) muscovite, 6.5 to 10.5 percent; 3) feldspar, 0.5 to 3.5 percent; 4) chert, 0.5 to 5.0 percent; 5) graphite, 0.0 to 0.5 percent; and 6) matrix (chiefly silt and clay), 0.5 to 10.0 percent. Ninety-three to 100 percent of the quartz grains are angular.

Heavy minerals from the Coffee, Selma, Coon Creek, McNairy, and Owl Creek Formations show no significant regional or stratigraphic variations. The heavy mineral suite is composed dominantly of metamorphic minerals with minor amounts of minerals derived from igneous rocks and pre-existing sedimentary rocks. The heavy minerals are, in order of relative abundance, kyanite, staurolite, tourmaline, zircon, sillimanite, rutile, monazite, hypersthene, andalusite, epidote, garnet, chloritoid, xenotime, ilmenite, leucoxene, and magnetite. Approximately 84 percent of the tourmaline grains and approximately 73 percent of the zircon grains are angular. The rounded and subrounded grains are derived mainly from pre-existing sedimentary rocks.

Three main types of clay minerals occur in the Upper Cretaceous sediments, kaolinite, mica (illite), and montmorillonite. The clays in the Tuscaloosa, Coffee, and McNairy Formations are chiefly kaolinite, are chiefly montmorillonite in the Selma and Owl Creek Formations and are mixtures of kaolinite, mica (illite), and montmorillonite in the Coon Creek Formation.

The McNairy Formation sands are fine to medium grained and well sorted. Only the median diameter shows any significant regional variation. In the eastern part of the area the median diameter is coarser than to the west and south.

The vectoral mean of 920 cross-stratification observations is 237°. Cross-stratification is well oriented with only a minimum of dispersion and with no significant regional variations.

The Cretaceous sediments of the Upper Mississippi Embayment are deltaic in nature. The fluviatile and upper deltaic environment, which occupied the eastern and northern part of the area, is represented by the Coffee and McNairy Formations; the delta front platform is represented by the Coon Creek Formation; and the pro-delta shelf is represented by the Selma and Owl Creek Formations.

The source area of these materials was located in the Blue Ridge and Piedmont Plateau of the Southern Appalachian Mountains. A humid, temperate to subtropical climate is suggested for the Mississippi Embayment and the Southern Appalachians during the Late Cretaceous. The sediments were transported to the Mississippi Embayment by a low gradient stream system which flowed between the Cincinnati Arch and Nashville Dome and entered the northeast end of the Mississippi Embayment.

The clay mineral composition of the sediments strongly reflects the environments of deposition. The fluvial clays are dominantly kaolinite, the marine outer neritic dominantly montmorillonite and the transitional inner neritic are mixtures of kaolinite, mica (illite) and montmorillonite.

Microfilm $2.75; Xerox $9.60. 211 pages.

THE GEOLOGY OF THE FLAG POND QUADRANGLE, TENNESSEE-NORTH CAROLINA.

(L. C. Card No. Mic 59-4260)

Ebraham Shekarchi, Ph.D.
The University of Tennessee, 1959

Major Professor: George D. Swingle

The area studied covers about sixty square miles including parts of Unicoi, Washington, and Greene Counties, Tennessee, and Madison County, North Carolina. It lies between Bald and Big Butt Mountains of the Unaka Range in the Blue Ridge physiographic province and is drained by the Nolichucky River on the north and east and by the French Broad River on the southwest.

A detailed surface map of the area and a microscopic study of representative rock samples was made. The geology of the area is divisible into two natural parts, the crystalline complex and the sedimentary sequences. The crystalline complex is divided into two groups, Flag Pond granite and Unakite granite. Both groups contain mylonite, pegmatite, diorite bodies, basic dikes, and various types of granite. The Flag Pond granite group is a medium- to fine-grained granite with units of sheared biotite granite which were not seen in the Unakite granite group. The Unakite granite group is a coarse-grained granite and contains epidote and Unakite granite which are lacking in the Flag Pond group. Both groups are considered to be Precambrian. The Flag Pond granite group possibly arose as a true granite or may have been produced by a regional metamorphism while the Unakite granite group was probably the product of a metasomatism or assimilation of aluminous sediments. The sedimentary sequence is divided into the Ocoee series of Precambrian age, with two distinct formations, Snowbird and Sandsuck, and the Chilhowee group of early Cambrian age with three formations, Unicoi, Hampton, and Erwin. An unconformity between the Unicoi and Sandsuck formations marks the base of the Cambrian in this area.

At least two periods of orogeny affected the area. One is reflected by metasomatism or assimilation of preexisting rocks which took place in the Precambrian. The other orogeny was thrusting of the Buffalo Mountain thrust sheet which took place at the end of Paleozoic time and is marked by mylonitization of crystalline complex and faulting and folding of the sedimentary sequences.

Microfilm $2.35; Xerox $8.20. 179 pages.

GEOLOGY OF THE PASS CREEK AREA, HUERFANO AND COSTILLA COUNTIES, COLORADO.

(L. C. Card No. Mic 59-3961)

Edward Carl Stoever, Jr., Ph.D.
University of Michigan, 1959

The Pass Creek area in the eastern margin of the Sangre de Cristo Range overlies the eastern part of what was the Central Colorado basin during the Pennsylvanian and Permian. The edge of this basin is apparently marked by a fairly abrupt eastward rise of the Precambrian basement complex, and it may be located along a buried northwest-trending fault zone of Pennsylvanian or younger age.

Very late Paleocene and early Eocene compression acting along east-northeast lines formed folds and northeast-directed thrust faults in Pennsylvanian, Permian, Jurassic, Cretaceous, and Paleocene strata. These structures are parallel to the northwest trend of the Sangre de Cristo Range, and are also parallel to the trends of Permo-Pennsylvanian tectonic elements. They offer a striking example of the persistence and influence of major tectonic elements throughout geologic time. Recognition of two major thrust faults of several miles displacement allows a zone of marginal thrust-faulting previously recognized farther north in the Sangre de Cristo Range to be extended southward.

Intrusion of monzonitic, rhyolitic, and basaltic magmas by forceful injection followed compressive deformation, and resulted in the formation of numerous dikes and sills as well as a few linear stocks. Fractures paralleling the strike of the sedimentary bedding were most favorable for intrusion. About two-thirds of the igneous bodies occupying these fractures are sills and the rest dikes. Faults and conjugate shear joints related to the folding were also occupied by the rising magma. The intrusions probably occurred in middle or late Eocene, but may have been as late as Miocene.

Extensive talus aprons and rock glaciers surrounding some stocks are due to frost action coupled with landsliding over saturated shales, and probably had their maximum development during the Pleistocene.

Microfilm $2.00; Xerox $5.60. 114 pages.

GEOLOGY OF A PART OF THE SOUTH-CENTRAL CASCADE MOUNTAINS OF WASHINGTON.

(L. C. Card No. Mic 59-3348)

Martin Lindy Stout, Ph.D.
University of Washington, 1959

Chairman: Howard A. Coombs

The geographic center of the mapped area is 68 miles southeast of Seattle and 37 miles northeast of Mt. Rainier, Washington. The area includes approximately 275 square miles and extends 25 miles easterly from the Cascade Crest between the Yakima and Naches Rivers.

The oldest rocks are pre-Tertiary igneous and metamorphic rocks which crop out in two northwesterly-trending belts. Most of the metamorphic rocks in the northern part of the southern belt are in tectonic contact with lower Tertiary sedimentary and volcanic rocks which in turn separate the two pre-Tertiary belts. Very few relative ages of the pre-Tertiary rocks are known.

Rocks in the southern pre-Tertiary belt are synkinematically metamorphosed, medium grade amphibolites which have been intruded by rocks of quartz dioritic composition, biotite schists commonly containing muscovite, and garnet and staurolite porphyroblasts and associated with hornblende-bearing hornfels (Lookout Mtn. unit), biotite gneisses, greenschists, and a tectonic-shear complex of metasedimentary rocks, epidosites, blastomylonites, greenschists and serpentinites.

The northern pre-Tertiary belt consists of quartz dioritic gneisses, migmatites, hornblendites, mylonites and medium grade amphibolites which are in tectonic contact with the Easton schist--a series of low grade metamorphic rocks consisting of graphitic phyllites, albite schists and actinolitic greenschists with minor blue-amphibole schist intercalations.

Unconformably overlying the pre-Tertiary rocks is the Naches formation, a complex series of interbedded sedimentary and volcanic rocks. The sedimentary rocks are most abundant and consist primarily of arkosic to feldspathic sandstones with minor amounts of quartzose sandstones, carbonaceous siltstones and shales commonly with leaf imprints, polymictic and silica-pebble conglomerates, coal and volcanic-derived sandstones and siltstones. The volcanic rocks are predominantly basalts and rhyolitic rocks with minor fragmental and effusive andesitic rocks. Arkosic sandstones and basalts are most common in the lower part of the formation; rhyolitic rocks are ubiquitous through the formation and andesitic rocks predominate in the upper part of the formation. The Naches formation is at least 8000 feet thick. Rocks in the Naches formation have been deformed into open folds with moderate dips on the flanks and in places are tightly folded with overturned limbs. The age of the Naches formation based on floral evidence is principally Eocene.

Unconformably overlying the Naches formation as well as the pre-Tertiary rocks are a variety of andesitic rocks referred to as undifferentiated rocks of Keechelus type. Representative lithologies are andesitic and basaltic flows, pyroclastic rocks including stratified tuffs, andesitic-rich, consolidated "mudflow" material, volcanic conglomerates and breccias, and rhyolitic rocks. The structure is difficult to determine as the rocks are rarely bedded, but they are not deformed as much as the lower Tertiary rocks. Their thickness is greater than 1000 feet and their age is believed to be principally Oligocene.

The next youngest unit is the Mio-Pliocene Yakima basalt, a series of basaltic flows with interbeds of tuffaceous sandstones and siltstones, palagonitic breccias and volcanic-derived conglomerates. The Yakima basalt is part of the extensive Columbia Plateau basalts.

The pre-Tertiary and Tertiary rocks have been intruded by many diabase masses. At least two different times of intrusion are represented by the diabase intrusions. Other Tertiary intrusive rocks are quartz gabbros to basalt porphyries, hypersthene basalts, vitrophyres, and rhyolitic dikes.

The most pronounced structural trends in the area are northwesterly across the northerly topographic alignment of the Cascade Mountains. The Tertiary structures parallel the pre-Tertiary structures and are undoubtedly in large part controlled by them. Pre-Tertiary faulting was intense, but limited exposures prevent a detailed analysis. At least one Tertiary fault, marked by serpentinite lenses, probably followed in large part one of the pre-Tertiary faults.

Extensive glacial ice was present in the Yakima Valley during part of the Pleistocene. The ice caused modifications of certain drainage relationships on the south side of Yakima Valley leaving a series of three wind gaps. At least once during their maximum advance, the glaciers in Yakima, Kachess and Cle Elum Valleys were all connected

Microfilm $2.75; Xerox $9.40. 210 pages.

A CHEMICAL, STATISTICAL AND STRUCTURAL ANALYSIS OF SECONDARY DOLOMITIZATION IN THE ROGERS CITY-DUNDEE FORMATION OF THE CENTRAL MICHIGAN BASIN.

(L. C. Card No. Mic 59-2651)

Betty M. Tinklepaugh, Ph.D.
Michigan State University, 1957

The Rogers City-Dundee (Devonian) formation in the central Michigan basin, although normally a marine limestone, is in many places an extremely porous dolomite. Oil fields producing from the Rogers City formation are generally limited to these dolomitic zones. The origin and characteristics of these dolomitic zones were the primary concern of this investigation.

A study of the possible relationships between secondary dolomitization, structure, and porosity was made over an area of approximately 400 square miles chosen in the Central Michigan basin where four major fields produce oil from the Rogers City formation.

Chemical analyses for calcium, magnesium, and iron content were made from samples within the top twenty feet of the Rogers City formation, in which the pay zones occur. The methods used were adopted by the author from Standard Methods for the Examination of Water, Sewage, and Industrial Wastes, published by the American Public Health Association, 1955. They were as follows:

1. Calcium analyses were made by the "Complexiметric" or versene titration methods as used for the determination of calcium hardness of water.
2. Magnesium and iron analyses were determined by spectrophotometric methods as adopted from water hardness tests.

These methods were highly accurate and extremely rapid as adapted for mass technique analyses.

Structural interpretations were made by an interpolation of a structure contour map of the area. Comparisons of this map with lithologic magnesium to calcium ratio maps were made to determine vertical and lateral relationships between structure and degree of dolomitization.

Statistical comparisons of the data were made by means of analysis of variance methods to determine relationships between: (1) dolomitization and structure, (2) dolomitization and porosity, (3) dolomitization and iron content of the limestones.

It was concluded from chemical analyses, structural and lithologic Mg/Ca ratio maps, and statistical analyses that in the top twenty feet of the Rogers City formation, including the prolific Coldwater oil field, there is a definite relationship between the degree of dolomitization and the magnitude of structure; there is a relationship between dolomitization and porosity, the nature of which is neither simple nor direct; and, there would appear to be an inverse relationship between iron content and the degree of dolomitization.

The magnesium-calcium ratio in limestones is a very useful geologic tool. It is especially useful in porosity studies and the location of dolomitized zones and structures.

The rapid and accurate techniques used in this study can enable geologists and petroleum engineers to make the Mg/Ca ratio determinations a routine analysis. Statistical studies may enable them to predict porosity of carbonate rocks and show the relationship between porosity and dolomitization for many limestones as yet unstudied.

Microfilm $2.05; Xerox $7.40. 156 pages.

STRUCTURE AND STRATIGRAPHY OF THE LA HONDA AND SAN GREGORIO QUADRANGLES, SAN MATEO COUNTY, CALIFORNIA.

(L. C. Card No. Mic 59-3726)

Roscoe Manville Touring, Ph.D.
Stanford University, 1959

The area of this report is in the Santa Cruz Mountains of California, 30 to 40 miles south of San Francisco, between the Pacific Ocean and the San Andreas fault.

A basement complex of pre-Upper Cretaceous igneous and metamorphic rocks is thought to underlie the area because it is found a few miles to the north and south. However, the basement complex is completely covered by sedimentary formations in the La Honda and SanGregorio quadrangles.

The oldest sediments exposed are shales, sandstones and conglomerates of an unnamed Upper Cretaceous formation in the southwest corner of the San Gregorio quadrangle. The next oldest sediments comprise the Eocene Butano formation. This unit, the base of which has not been found, consists of rhythmically interbedded sandstones, siltstones and mudstones which may have an aggregate thickness as great as 10,000 feet. The San Lorenzo formation overlies the Butano conformably and includes 1,900 to 3,000 feet of mudstones and sandstones of late Eocene (A-1 zone) and Oligocene age (Refugian and Zemorrian). Diabase sills as much as 600 feet thick intrude the lower San Lorenzo and are related to the igneous activity which supplied the volcanic material in the overlying Mindego formation. The Mindego formation is a new name given to at least 2,000 feet of late Oligocene and early Miocene (Zemorrian and Saucesian) calcarenites, arkosic sandstones, siltstones, mudstones, basalt flows, flow breccias and tuffs which lie disconformably or with slight angular unconformity on the San Lorenzo formation. The Mindego formation is equivalent in age to some of the massive fossiliferous sandstones that have been called Vaqueros sandstone in nearby areas. The Woodhams formation is the new name given to about 500 feet of siliceous mudstone and foraminiferal shales (Relizian?) which conformably overlie the Mindego formation near the east edge of the La Honda quadrangle.

The Monterey formation is restricted to late Miocene (Delmontian?) brown, siliceous mudstones and porcelanites which lie upon older formations unconformably. The Monterey is 9,000 feet thick in the west and thins to a wedge edge in the east. The Pliocene Purisima formation overlies the Monterey conformably, has a maximum thickness of 5,650 feet, and can be divided into five mappable members which are here named and described. The basal Tahana member consists of 2,150 feet of tuffaceous mudstones, siltstones and lithic arenites believed to have been largely derived from the andesitic Mehrten formation in the Sierra Nevada. The Pomponio member consists of about 2,300 feet of rhythmically interbedded siliceous mudstones and siltstones with a sandstone, siltstone and mudstone facies locally developed. The San Gregorio

sandstone member is composed of 150 to 350 feet of lithic arenites. The Lobitos mudstone is 450 feet thick and it is overlain by the Tunitas sandstone member which has a maximum thickness of 400 feet. Seven plates illustrate the Purisima megafauna and systematic notes on 70 species from the formation are given. The megafauna of the formation suggests that water depths during deposition of the formation ranged from 10 to 45 fathoms.

Quaternary deposits include marine and stream terraces, landslides, alluvium, and beach sands.

At least four periods of Cenozoic crustal activity are recorded in the area of this study. Slight deformation occurred with the igneous activity in late Oligocene time. Gentle northwest-trending folds developed during the middle Miocene, and in the mid-Pleistocene these older structures were intensified and many new faults and folds developed. Gentle warping has taken place since the development of the marine terraces.

One small oil field in the La Honda quadrangle has seven wells producing from the Butano formation. No important mineral resources in addition to oil are known.

Microfilm $3.80; Xerox $12.80. 294 pages.

A STUDY OF HISINGERITE AND RELATED SILICATES.

(L. C. Card No. Mic 59-3769)

James Arthur Whelan, Ph.D.
University of Minnesota, 1959

Hisingerites are soft, black, hydrous, ferric silicates with a characteristic resinous luster and conchoidal fracture. Samples from the Ferrogabbro and Black Bay gabbro, Beaver Bay complex, Minnesota; Parry Sound, Ontario; Montauban Mines, Quebec; Eastern Mesabi range, Minnesota; and Cuyuna range, Minnesota were studied. Neotocite from the Montreal Mine, Wisconsin, a manganese analogue of certain hisingerites, was also investigated.

X-ray diffraction studies showed all the hisingerites except that from the Eastern Mesabi to have poorly developed nontronite structures. The Eastern Mesabi hisingerite and the neotocite are intimate mixtures of serpentine and (?) talc structures.

Chemical analyses were used to calculate structural formulas for the nontronite-type hisingerites.

Nontronite-type hisingerites contain more iron and less aluminum than normal nontronites. The assumption that hisingerites form as metastable ferrous nontronites can account for the higher iron content of hisingerites.

The DTA curves of the nontronite-type hisingerites do not show as well-defined thermal reactions as normal nontronites. The DTA curve of the serpentine-type hisingerite consists only of an endothermic reaction at about 150°C. which represents loss of water. The DTA curve of neotocite is similar to that of serpentine.

The optical properties of hisingerites are extremely variable. Some specimens are essentially isotropic; others are anisotropic. Both types of hisingerite show an irregular habit under the electron microscope.

The specific gravities of these hisingerites average about 2.5.

The Beaver Bay hisingerite, thought to be deuteric, replaces olivine and to a lesser extent pyroxene. The Parry Sound hisingerite, formed by ore-forming solutions acting on country rock, replaces hypersthene and to a lesser extent plagioclase, siderite, and sulfides. The Montauban Mines hisingerite, also related to ore deposition, replaces diopside and to a lesser extent plagioclase, siderite, and sulfides. The Eastern Mesabi hisingerite occurs as veins cutting the iron formation.

Amorphous materials similar in composition to hisingerite were prepared by neutralizing Na_2SiO_3 solutions with $FeCl_2$ solutions. The experiments were performed in CO_2 or H_2 to prevent oxidation of the ferrous ion; however, on drying, even in the above-mentioned atmospheres, the precipitate oxidized. Precipitates prepared in CO_2 contained siderite. When heated with water in a closed tube for 100 days the amorphous precipitate did not crystallize; the material containing siderite developed some nontronite after 84 days.

Nontronite with physical properties similar to hiningerite and believed to be equivalent to hisingerite was synthesized by adding a boiling $FeCl_2$ solution to a boiling Na_2SiO_3 solution and maintaining the mixture at 100°C for 4 days. All attempts to make nontronites from ferric materials failed.

Hisingerites and normal nontronites react differently to treatment with hydrochloric acid. Hisingerites are decomposed to silica residues. Normal nontronites are not decomposed in concentrated hydrochloric acid, even when boiled for five minutes; however, their basal spacings collapse to those of micas. It is postulated that the hydronium ions substitute for the potassium ions of normal micas.

The writer concludes that both types of hisingerite are genetically related to basic intrusives. Though generally formed by hot waters, the formation temperature of these minerals is thought to be low, no more than 100 to 200 degrees centigrade.

Since minerals with two different structures have been designated hisingerite, it is not a mineral species. It is recommended that the term hisingerite be retained as a petrographic term for dark-colored, soft, resinous-appearing, hydrated ferric silicates. Variety names should be dropped; however, the term manganhisingerite might be retained for material with an appreciable manganese content.

Microfilm $2.20; Xerox $7.80. 166 pages.

HEALTH SCIENCES, GENERAL

BIS-MESYLATES: I. SYNTHESIS AND MECHANISM OF FORMATION. II. EVALUATION OF HEMOPOIETIC EFFECTS AND INHIBITION OF MOUSE SARCOMA 180 AND MOUSE EHRLICH'S ASCITES TUMOR IN YOUNG MICE.

(L. C. Card No. Mic 59-982)

Wayne H. Finley, Ph.D.
University of Alabama, 1958

Chairman: Emmett B. Carmichael

Some chemical compounds, which have been shown to be structurally related to 1,4-dimethanesulfonyloxybutane (Myleran), have been synthesized and studied as possible anti-tumor agents. These drugs have been considered to have the potentiality of acting as alkylating agents under physiological conditions and have presented variations in reactivity, configuration and absorption. Variations both in the butane alkylating chain and in the nature and length of the side chains of the Myleran structure have provided the basis for the study of the relationship of their role in tumor growth inhibition to their chemical structural characteristics.

Difficulty was encountered in synthesizing the bis-mesylate of cis-2-butene from 2-butene-1,4-diol and methanesulfonyl chloride which is the classical procedure, so the general method of the reaction of silver methanesulfonate with the respective dibromo-intermediates was adopted. The bis-mesylates of butane, cis- and trans-2-butene, 2-butyne, and m-, o-, p-xylene were prepared by the latter reaction. The compound containing oxygen between carbon atoms 2 and 3 of the Myleran structure was synthesized by reaction of diethylene glycol with methanesulfonyl chloride in pyridine. In the synthesis of cis- and trans-1,4dimethanesulfonyloxy-2-butene two interesting isomerizations occurred. When aqueous solutions were used in the course of the reaction of phosphorus tribromide with cis-2-butene-1,4-diol, the trans-1,4-dibromo-2-butene was obtained; but, if anhydrous conditions were employed the cis configuration was maintained. When pure cis-1,4-dibromo-2-butene was allowed to react with silver methanesulfonate in acetonitrile, a mixture of both isomers was obtained. This isomerization perhaps occurred either as a S_N1 or S_N2 reaction or even as an unrelated prior isomerization before the reaction with silver methanesulfonate.

In addition other compounds were obtained from another source:* tetramethylene glycol-bis-1-octanesulfonate, tetramethylene glycol-bis-1-heptanesulfonate, tetramethylene glycol-bis-1-butanesulfonate, tetramethylene glycol-bis-1-ethanesulfonate, neopentyl glycol bis (α-toluene sulfonate), 1,4-dineopensyloxybutane, 1,4-di-α-tosyloxybutane, neopentyl glycol bis (neopentane sulfonate), and 1,2-di-α-tosyloxypropane.

A study of the animal toxicity (LD_{50-1}) of all seventeen compounds was made. Data obtained for the three compounds which varied in the degree of saturation of the butane alkylating chain showed that as saturation decreased toxicity also decreased. The cis- bis-mesylate of 2-butene was more toxic than the trans isomer. The toxicity of the xylene bis-mesylates was determined for rats, mice and hamsters. It was found that the order of increasing toxicity was as follows for rats and hamsters: para, ortho and meta. In the case of mice the order was para, meta and ortho. The introduction of oxygen into the butane alkylating chain gave a compound which was markedly less toxic than the other compounds with only variations in the alkylating part of the molecule. Lengthening or changing the nature of the side chains gave compounds with reduced animal toxicities.

A study of the growth inhibition of mouse Sarcoma 180 and Ehrlich's mouse Ascites Tumor by these alkylating agents has shown that all these compounds show at least borderline activity. The unexpected marked anti-tumor effect of trans-1,4-dimethanesulfonyloxy-2-butene, as great as that for Myleran, was in contradiction to previous reports, in that the close proximity of the two alkylating centers was considered important for carcinostatic activity. Although they did not show more than borderline anti-tumor effect against Sarcoma 180, o- and p-xylyene dimethanesulfonate did show marked activity against Ehrlich's mouse Ascites Tumor.

Since the main clinical side effect of Myleran has been bone marrow depression, it became desirable to determine the effects of these agents on the animal hemopoietic system. Of all the compounds studied, the trans-1,4dimethanesulfonyloxy-2-butene and the xylene bis-mesylates showed the most anti-tumor effect, but they did not display as marked anti-bone-marrow effects as did Myleran.

In summary this study indicates that with these compounds (1) bone marrow depression and anti-tumor effect are not related entities and (2) that there is no direct relationship between animal toxicity, anti-bone-marrow effect and anti-tumor effect.

Microfilm $2.20; Xerox $7.80. 167 pages.

*Dr. R. B. Scott, Professor of Chemistry, School of Chemistry, University of Alabama, University, Alabama.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

HEALTH SCIENCES, NURSING

A CRITICAL ANALYSIS OF PUBLIC SCHOOL NURSING IN NEW JERSEY.

(L. C. Card No. Mic 58-5726)

Ruth Arnold Klein, Ed.D.
Rutgers University, 1958

I. INTRODUCTION

Prominent among the problems in school nursing is the uncertainty within the profession as to the appropriate functional role of the nurses serving in the public schools. The functions of the school nurse are sometimes confused with those of other pupil-personnel specialists.

While the profession of school nursing has progressed rapidly since its inception at the turn of the century, the professional preparation of school nurses has not kept pace with the growth of nursing services provided by the public schools.

II. STATEMENT OF PROBLEM

This study proposed to analyze critically the functions of the school nurse serving in public schools of the State of New Jersey.

III. PLAN OF PROCEDURE

The present investigation involved a fivefold procedure: (1) study of health services provided by the public schools of New Jersey; (2) study of the professional status of the public school nurse in New Jersey; (3) study of the functions and responsibilities of the school nurse; (4) examination of official records for educational programs in nursing offered by institutions in the State; and (5) the collection of printed material about legal acts pertaining to the school nurse and school nursing services.

IV. CONCLUSIONS AND IMPLICATIONS

A critical analysis of public school nursing in New Jersey has revealed a number of significant conclusions and implications.

Conclusions. The vast majority of public school nurses in New Jersey have obtained only the basic nursing school diploma — only a small portion hold an academic degree of any kind.

The hospital schools of nursing rather than the collegiate schools are the principal institutions preparing the public school nurses for their positions.

The technical competency obtained through the basic nursing diploma program does not adequately prepare nurses for public school nursing. Therefore, it is necessary for the nurse to continue her education in order to perform the school nurse functions not only in her specialized area of preparation but also in her personnel work.

As the number of nurses employed in New Jersey has increased, there has been a concurrent strengthening of the certification requirement for public school nurses.

In many respects the school health services, as currently operating in the public schools, do not measure up to minimal recommended standards.

Implications. The responsibilities of the school nurse should be defined by the school administration in consideration of her professional preparation and nursing experiences.

Systematic procedures should be established to guide the school nurse in her work.

In order to achieve an effective school nursing program an attempt should be made to strengthen those portions of the school health services program which do not meet acceptable standards.

In-service instruction in health services and health education for all faculty personnel should be encouraged.

The school nurse should assume a more significant role as a guidance functionary.

The established nursing functions performed most frequently by the school nurse should be given major emphasis in professional preparatory programs.

Effort should be made to describe further the required subject matter areas specified for the school nurse certificate.

The nature and scope of the problem, analyzing critically the functions and the programs for the professional preparation of the school nurse, and the results that have been presented in this report indicate that although considerable progress has been made in putting school nursing on a professional basis there is yet much to be accomplished. The matter of preparation, the delineation of job functions particularly with respect to the growing importance of the school nurse as a guidance functionary, and her operational relationship to other staff members are areas that lend themselves to further exploration and refinement. Microfilm $6.75; Xerox $23.40. 532 pages.

HEALTH SCIENCES, PATHOLOGY

THE PATHOLOGIC RESPONSE OF THE DEVELOPING CHICKEN EMBRYO TO CERTAIN AVIAN PATHOGENS.

(L. C. Card No. Mic 59-3834)

Donald Roy Casorso, Ph.D.
The University of Connecticut, 1959

The viruses of avian encephalomyelitis (AE), synovitis, Newcastle disease (ND), infectious bronchitis (IB), pleuropneumonia-like organism (PPLO) of chronic respiratory disease and infectious turkey sinusitis, and the agent of avian infectious hepatitis (AIH) were inoculated into chicken embryos for the purpose of determining the pathologic response of this host system. Killed and exsanguinated embryos were examined at 24 hour intervals for an average of 11 days postinoculation and subjected to histopathologic examination at 8 cross sectional and 1 parasagittal, levels. A total of 2000 infected embryos were employed with 400 diluent-inoculated embryos serving as controls. - AE caused atrophy of the embryos and microscopically, neuronal degeneration in the ventral horns of the spinal cord and dorsal ganglia. Skeletal muscles showed extensive muscular dystrophy and the CNS edema, encephalomalacia and terminal internal hydrocephalus. - Synovitis produced splenomegal and hepatomegal, marked perivascular reticular cell proliferation in the liver and occasionally in gizzard, skeletal muscles and mesonephros. - PPLO,

consisting of hemagglutinating and non-hemagglutinating strains, produced widespread heterophilic perivasculitis, most prominent in the liver. - Livers of AIH infected embryos had a greenish cast and microscopically, showed early focal necrosis, regenerated liver cord cells about the hepatic vessels, occasional aggregates of heterophils accompanied by bile duct proliferation, and bile stasis. -ND and IB viruses to date have not produced consistent microscopic lesions in the embryo possibly because of the employment of embryos from immune dams. - The pathologic response of the chicken embryo is considered contributory to the differentiation of certain avian pathogens.

Microfilm $2.00; Xerox $6.20. 128 pages.

A CLINICO-PATHOLOGICAL STUDY OF SMALL ANIMAL DERMATOSES.

(L. C. Card No. Mic 59-3763)

Robert Mayer Schwartzman, V.M.D., Ph.D.
University of Minnesota, 1959

The purpose of this study is to define the gross and histologic pathology of 302 canine dermatologic cases presented to the Veterinary Clinic of the University of Minnesota, St. Paul, Minnesota (March 1957 to June 1958) and to correlate these findings with historical information and clinical signs and symptoms. In addition, the causative factors are sought and discussed as interpreted from the accumulated data.

Interdigital foreign body granuloma, acral pruritic granuloma, pyoderma, lip fold pyoderma, acute pyo-traumatic dermatitis, chronic flea bite dermatitis, seborrheic complex, demodectic mange, seasonal pruritus, hormonal alopecia, axillary intertrigo, pressure sores and lichenification on the lateral folds of the flank are discussed with special reference to clinical findings, histopathology and etio-pathogenesis. Insect bites, granulomas, urticaria, North American blastomycosis, apocrine miliaria, keratosis pilaris, cicatrizing alopecia, dracunculosis and dermatophytosis are described clinically and histopathologically without reference to etio-pathogenesis. Clinical and historical data from 100 canine cutaneous tumors are presented in tabular form.

The most important fact that evolves from this study is that self-inflicted trauma and/or bacterial infection are the two most important factors in the pathogenesis of canine dermatoses. Although one cannot define the pruritic factor in each entity, it should be understood that the dog, when it experiences the itch sensation, responds by any available means--rubbing, biting, scratching or licking--to remove the itch sensation. In addition, the traumatized skin serves as an ideal medium for secondary bacterial infection. Thus, the animal often produces the dermatitis which is presented to the veterinarian.

The response of canine skin to self-inflicted trauma appears to vary with the area involved and the type of trauma. Prolonged irritation or licking of the groin, axilla or lateral skin fold of the flank result in lichenification (axillary intertrigo and lichenification on the lateral folds of the flank). Licking of the extremities results in a fibrotic nodule or tumor (acral pruritic granuloma. Scratching, biting or rubbing of the face, dorsla and lateral trunk result in an acute, discrete, circular ulcer (acute pyo-traumatic dermatitis) or in a diffuse, chronic dermatitis (chronic flea bite dermatitis).

When examined histologically, the lesions of the various dermatoses show limited reaction patterns. Most lesions present, on histologic examination, an acute ulcerative dermatitis or a subacute or chronic, nonspecific dermatitis. Because of the lack of specificity of pathologic reactions, differential diagnoses would be difficult to make by microscopic examination. Although it is too early to reach any conclusions regarding the diagnostic value of biopsy procedures for canine dermatoses, it appears at this point that the biopsy best serves etiologic studies rather than diagnostic. It is noted though that the canine skin does show some interesting pathologic features:

1. The granular layer is often present beneath the parakeratotic horny layer.
2. Plasma cells often tend to aggregate around the apocrine structures.
3. Vesiculation is rare.
4. Scales and crusts are not strongly adherent and are usually lost in obtaining tissue specimens or in tissue preparation.

It is clearly evident that large gaps in our knowledge of canine dermatology exist and that much investigative work must be undertaken. The following are areas of research that merit special attention:

1. Definition of the normal cutaneous flora of the dog.
2. Investigation of the effects of hormones on the pilosebaceous apparatus of the dog.
3. Definition of the shedding cycle of the dog and characterization of hair in different body areas.
4. Investigation of the reaction of canine skin to trauma, with special reference to types of trauma and areas of the body.
5. Further histopathologic and etiologic studies of canine dermatoses.

Microfilm $2.15; Xerox $7.60. 164 pages.

HEALTH SCIENCES, PHARMACY

THE EFFECTS OF EIGHT SELECTED CENTRALLY ACTIVE DRUGS ON BOTH OPERANT AND AVOIDANCE-ESCAPE CONDITIONING.

(L. C. Card No. Mic 59-3828)

Mario Domenico Giulio Aceto, Ph.D.
The University of Connecticut, 1959

This study was undertaken in order to compare the effects on conditioning of well known classes of tranquilizers both with themselves, and with other centrally active drugs. In addition, on the basis of certain chemical structure relationships, 2-ethyl-2-(3-methyl)-butylmalondiamide

and 2-ethyl-2-(3-methyl)-butylmalonic acid diethylester were included for study in this investigation.

Two experimental procedures employed for use in this investigation were an avoidance-escape conditioning procedure (modified pole climbing) and an operant conditioning and extinction situation (modified Skinner bar-press). Rats served as the experimental animals in both procedures.

The results of the avoidance-escape procedure were analyzed by means of a Split-Plot Analysis of Variance technique and t tests. The results strongly suggested that significant differences existed when the drugs were compared with one another and to the controls considered from both dosage and trial aspects. Reserpine phosphate and chlorpromazine hydrochloride were found to increase the latency of response. Hydroxyzine hydrochloride (25 mg. kg.) dextro-amphetamine sulfate (1 mg./kg.), amobarbital (5 and 10 mg./kg.) 2-ethyl-2-(3-methyl)-butylmalondiamide (10 mg./kg.), and 2-ethyl-2-(3-methyl)-butylmalonic acid diethylester (50 mg./kg.) decreased the latency of response.

Due to the "noise" in the operant conditioning and extinction procedures, few significant effects were determined statistically by means of the t tests. In general, for both the operant conditioning and extinction procedures, it was found that only those drugs which interfered with normal motor activity as amobarbital, meprobamate, and 2-ethyl-2-(3-methyl)-butylmalonic acid diethylester, and drugs with anorexic properties as dextro-amphetamine sulfate had significant effects when compared to the controls. Microfilm $2.00; Xerox $3.00. 58 pages.

SOME PHARMACEUTICAL ASPECTS OF AL-ZAHRAWI'S AL-TASREEF ABOUT 1000 A.D.

(L. C. Card No. Mic 59-3193)

Sami Khalaf Hamarneh, Ph.D.
University of Wisconsin, 1959

Supervisor: Associate Professor Glenn Sonnedecker

Abu al-Qasim Khalaf ibn Abbas al-Zahrawi, known in the West as Abulcasis (died c. 1013 A.D.), wrote his encyclopedic work, "al-Tasreef," on medicine, surgery and pharmacy in thirty treatises. He was renowned in the Middle Ages and up to modern times as a surgeon and a physician.

Except for his twenty-eight treatise, the famous "Liber Servitoris," little has been known of his contribution to pharmacy. Yet, through a careful examination of Arabic manuscripts of al-Tasreef (obtained on microfilms from eleven countries) we found that of the thirty treatises comparing the entire work the majority are pharmaceutical or related to the subjects of pharmacy. This places al-Tasreef in a new light, and as far as we know the character of this work has been neither heretofore clarified adequately nor the pharmaceutical part evaluated.

In regard to the forms of pharmaceutical preparation, the work discusses: tablets with drawing of moulds employed and methods applied; powders and their medicinal uses; robs and conserves with emphasis upon the skill of making and storing them properly; syrups, electuaries, ointments and many other forms of products which are administered for healing purposes. In these discussions the author mentions not only the compounding processes and the therapeutic effects of these drugs, but he goes on to describe the technic involved in their manufacture in quantities to be ready at hand as need arises. He also presents studies of the equipment and means employed to introduce new or improved medications from minerals (such as litharge and vitriols), plants (as juices and gums) and animals (like wax and fats). He also carefully and precisely describes methods and technics used in these preparations: filtering explained by drawings of strainers used, which are the first illustrations of this kind we know in Islam; decoctions; distillation of oils and aromatic waters; together with processes of drying, extracting and storage.

Of particular interest to pharmacy, although so far almost unremembered in literature, is the twenty-fifth treatise on "al-Adhan." It seems obvious from evidence in the methods of preparation, in the technic involved to secure them, and in the elaborate presentation of their properties, that these substances are not always equivalent to oils, whether fixed or volatile, as many historians have assumed. The Arabic word "adhan" used by al-Zahrawi does apparently mean that certain substances -such as olives, almonds, laurel, wheat, henbane, colocynth and even eggs- have fatness or oily essence in them that could be separated by pharmaceutical processes for use in medicine, either internally or externally or both.

Selected passages representative of treatise twenty-five are here translated and evaluated. Our study included three main aspects of interest to pharmacy: the pharmaceutical technic used in manufacturing; the precision of equipment and method employed; and the recording of al-Zahrawi's personal observations.

Although al-Zahrawi relied heavily on his predecessors, in classical and Arabic writings, yet his contributions in several pharmaceutical aspects prove to be of significance in the history of the health field.

Microfilm $4.20; Xerox $14.20. 328 pages.

THE EFFECT OF CERTAIN DRUGS ON AVOIDANCE-ESCAPE AND OPERANT CONDITIONING

(L. C. Card No. Mic 59-3848)

Vincent de Paul Lynch, Ph.D.
The University of Connecticut, 1959

This research was concerned with the effects of that class of compounds termed "tranquilizing drugs" on the acquisition of conditioning in an anxiety-producing situation, and on the acquisition and extinction of operant conditioning. In addition, a new drug, ethyl-2, 4-tolyly dicarbamate, was tested under the same circumstances.

White rats of both sexes were used for conditioning under the influence of drugs by means of a Pole-climbing apparatus for the Avoidance-Escape Conditioning, and a Skinner Box for the conditioning and extinction of operant behavior.

While the design of the operant conditioning experiment was too gross to allow for more than a cursory examination of the results, the Avoidance-Escape situation provided a considerable quantity of analyzable data. With this latter research, it was found, that significant

lengthening of response latency was caused by reserpine (1.0 and 2.0 mg./kg.), and chlorpromizine (4.0 mg./kg.) A decrease of response latency was caused by hydroxyzine (25.0 mg./kg), Dextroamphetamine (1.0 mg./kg.), amobarbital (5.0 mg./kg.), and the dicarbamate (all doses.). Meprobamate appeared to have no effect on the acquisition of these responses. These results were analyzed statistically by means of Analysis of Variance (Split-Plot), and the significance of individual drug effects determined by use of the t Test. Microfilm $2.00; Xerox $3.60. 64 pages.

EMULSIFICATION WITH ULTRASONIC WAVES

(L. C. Card No. Mic 59-3868)

Robert Eugene Singiser, Ph.D.
The University of Connecticut, 1959

A modified photomicrography process has been developed to speed the size-frequency method of analysis of emulsions. This method employed a film strip and grid simultaneously projected. Classification of the oil globules into the proper size interval was materially eased by use of a blood cell calculator. The time required for a complete 1000 count analysis was approximately one-half of that reported for other methods.

Four emulsifying apparatus were evaluated with 25% v/v mineral oil, peanut oil, and safflower oil emulsions, using with each of the following emulsifiers: (a) acacia, (b) Tween 40/Span 80, (c) Pluronic F-68/Span 80, and (d) sodium lauryl sulfate. The apparatus compared were: (1) the Eppenbach Colloid Mill and the (2) General Electric, (3) Sonogen, and (4) Minisonic ultrasonic generators. This was the first attempt to comparatively evaluate ultransonic equipment with conventional emulsification apparatus.

Each of the oils with each of the emulsifiers were prepared as rough stock premixes. Aliquots were drawn from the individual mixes and exposed in each apparatus for $2\frac{1}{2}$, 5, 10, and 15 minutes. The best of the four time-interval emulsions was analyzed after 0, 15, 30, and 60 days room temperature storage.

After the size-frequency analysis was completed the specific interfacial area, mean globule diameter, and standard deviation of each sample was calculated and graphed. Some objections to the complete dependence on specific interfacial area are cited.

It was found that the Minisonic generator produced emulsions of smaller mean globule diameter (or larger specific interfacial area) than any of the other apparatus. The Sonogen and G. E generators were approximately equivalent to the Eppenbach mill. Some secondary observations were made, such as relative efficiency of the emulsifying agents, relative ease of emulsifying the different oils, and advantages and disadvantages of the apparatus.

An investigation into the effect of time of exposure on emulsification by the Minisonic generator was conducted. No coagulation was observed in exposures up to thirty minutes. In some cases the prolonged exposure gave a gradual improvement in the emulsions.

Several different methods of forming the emulsions in the Minisonic generator were investigated. None of the methods significantly differed, but there are some inherent advantages to the single funnel-premix method.

Microfilm $2.00; Xerox $5.40. 108 pages.

HISTORY, GENERAL

FEDERAL LEGISLATION CONCERNING THE DISPOSITION OF GRAZING LANDS (1862-1900).

(L. C. Card No. Mic 59-3988)

Frank Carter Bell, Ph.D.
Indiana University, 1959

The United States began with a solid mass of land extending from the Atlantic coast to the Mississippi River and from the Great Lakes to, but not including, Florida. Seven of the original thirteen states with land claims west of the Appalachians reluctantly yielded these claims to the central government. Between 1802 when Georgia, the last to cede, gave over her rights to western land, and 1853 when the Gadsden Purchase was made, the United States took very nearly its present physical form. Thus, the United States obtained 3,000,000 square miles of which 1,400,000,000 acres constituted the public domain. By 1862, the period when this treatise begins, only one-third of this vast area had been disposed of.

Although much of the grasslands was to pass into private hands under the Homestead Act of 1862, it was not the boon to the downtrodden that it was expected to be. Most of the first-class land had already been taken up. Also, the allotted acreage was too small for grazing or dry farming and too large for irrigation. In any case, the conquest of the Plains required a "know-how" which even many western farmers did not have.

The Homestead Act was supplemented by other acts. The Pre-emption Act of 1814 was still in effect. The Morrill Land Grant Act of 1862 donated lands to the states for the endowment of colleges devoted to education in agriculture, engineering, and military science. The Timber Culture Act of 1873 gave additional Plains land to owners who planted trees. The Desert Land Act of 1877 granted 640 acres to a claimant who promised to irrigate them. Finally, the Timber and Stone Act of 1878, which was intended to apply to nonarable and nonmineral lands, enabled lumber and mining companies to acquire vast areas with invaluable resources.

Next to the states, the railraods were the greatest beneficiaries of federal land grants. From 1850-1871 the Federal government continued its policy of granting lands to aid in the construction of railroads. However, of the

total railroad mileage in the United States today, only about eight per cent received federal grants of land as an aid to construction.

Until 1889 the Federal government permitted unlimited cash purchase of land in all except a few reserved areas of the public domain. Indian tribes parted with their lands on condition that they receive the proceeds, and so these lands were usually sold en bloc to railroad and land companies.

By 1890 the frontier had dissolved into the Great Plains where aridity and the nature of the land itself called for more liberal terms of entry; moreover, there was concern over the inadequacy of existing legislation which made homesteading by honest compliance with the law nearly impossible. The Newlands Act of 1902, which resorted to the reservation principle, provided for the Federal government to assume the duty of reclamation. Thus, in 1900 more than half of the original public domain of around 1,400,000,000 acres still belonged to the Federal government. Microfilm $3.75; Xerox $12.80. 292 pages.

THE STRUGGLE FOR INTERNATIONAL COPYRIGHT IN THE UNITED STATES

(L. C. Card No. Mic 59-3448)

Wallace Putnam Bishop, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Warren S. Tryon

This dissertation stresses the economic and political aspects of the struggle for international copyright in the United States rather than the literary aspects. The author has attempted to do the following: first, to give a chronological history of the struggle; second, to give a general description of the economic effects of the lack of international copyright on the book industry, on the authors concerned, both British and American, and on the American people; third, to determine who favored and who opposed international copyright, and why they did so; fourth, to discover the reasons that the United States delayed so long in adopting copyright for foreigners; and fifth, to establish those causes which eventually led to the enactment of international copyright laws.

In 1790 the United States passed its first copyright act. However this act did not allow American copyright to foreign authors. It was not until 1836 that there was any important agitation to alter this situation. The first serious attempt to obtain copyright for foreigners came early in 1837, when Henry Clay introduced an international copyright bill in the Senate. This was the real beginning of the struggle. It continued until March, 1891, when Congress passed the Platt-Simonds Bill, the first American international copyright measure.

The fact that there was no international copyright law was very important in the rise of American publishing. The American publishers prospered and expanded greatly on the profits from reprinting the works of the popular British writers, to whom the publishers were required to pay nothing. American readers were given an inexpensive literature of very high quality. British writers protested angrily against what they considered the stealing of their works. Yet many of them received a good income from voluntary payments by American publishers. American writers complained that American literature was seriously retarded by the competition of cheap English books, and that an American could not make a living by his pen. However, even in the early days, there were Americans who did receive a substantial financial reward for their literary work, and, as time passed, there were more and more of them.

The fight for international copyright, in Congress and out, was sporadic and ineffective before the Civil War. This was due partly to the lack of sophistication in those carrying on the fight, and partly to the lack of a real urgency for such legislation. Almost everyone, except the authors, was prosperous and contented with things as they were. By the late 1870's, however, the picture had changed and there were various factors at work which were bringing about the conditions that made international copyright laws essential and inevitable. The passing away of the great popular British writers; the increasing attractiveness to American readers of American writers; the chaotic competition in the publishing industry; the effectiveness of the later copyright organizations in working for the cause, all contributed to a universal desire for reform. By 1891, almost all who were concerned in any way, except for a few special interests and a hard core of politicians in Congress (most of them representing the people of the South and West), favored international copyright.

Microfilm $3.15; Xerox $10.80. 242 pages.

THE ORGANIZATION, ADMINISTRATION, AND TRAINING OF THE UNITED STATES ORDINARY AND VOLUNTEER MILITIA, 1792-1861

(L. C. Card No. Mic 59-3913)

Lyle D. Brundage, Ed.D.
University of Michigan, 1959

The purpose of this study is to examine and describe the militia system of the United States and the effort to cultivate and diffuse among the people a knowledge of military matters during approximately the first half of the nineteenth century, with particular reference to the two kinds of militia--volunteer and ordinary or regular. One of the objectives of the examination and description is to discover and explain the military institutions and developments during the period which affected later developments in this country. It is believed that such a study will, to some extent, be a means for judging the effectiveness of some of our present-day military organizations, such as the United States Army Reserve and the National Guard.

The study shows that the militia of the early national period grew out of that which existed in all the colonies during the seventeenth and eighteenth centuries. In connection with the organization, administration, and training of the volunteer and ordinary militia, the following subjects are discussed: the first national militia law of 1792; the general organization of the militia from 1792 to 1840; the volunteer or uniformed militia organizations from 1792 to 1860; methods for calling the militia into the service of the United States or one of the several States; arming, supplying, and paying the militia; the provisions for

exemptions and substitutes during peacetime and wartime; delinquencies and the pecuniary system of punishment; methods of securing and commissioning officers; uniforms and the participation of the uniformed volunteer militia in the life of the times; training days and training methods; development of the idea of the training encampment; and the writing, publication, and procuring of training literature. With regard to the last, a rather detailed survey and review of the most important training literature of the period is made. It is shown that the militia system as it existed during the period from 1792 to 1840 became very distasteful to many people, chiefly because of the unfairness and faults in the methods of organization, administration, and operation. During the years previous to 1860 the ordinary militia degenerated. However, the causes for the degeneration rested not so much in the fact that the militiamen failed the nation, as in the fact that the national organization failed the militia.

Weaknesses in the militia system are indicated as follows: (1) There was a waste of manpower due to the attempt to extend training over too long a period during the life of the individual militiaman. (2) There were several unfair features in the organization and administration of the system both from the standpoint of the individual militiaman and from the standpoint of the indivudual State. (3) There was a lack of uniformity and general control when militia units were assembled from different States and used in conjunction with the Regular Army. (4) No adequate system of administration on the part of the National Government was developed in such matters as the service of supply and the paying of militia when it was called into the service of the United States. (5) The training program was not effective because of the lack of good instructors and uniform, up-to-date training literature and aids; poor distribution of the training periods; insufficient financial support from both the State and National Governments; poor training objectives which were often not within the tactical capabilities of the ordinary and volunteer militia; and inadequate supervision from both the State and National Governments. (6) There was a serious lack of competent and well-trained officers and noncommissioned officers, aggravated by systems of selections and appointments which very often failed to provide opportunities for the better qualified persons.

Microfilm $5.95; Xerox $20.80. 466 pages.

FREDERICK WILLIAM MAITLAND: CONTRIBUTION TO THE HISTORY OF ENGLISH LAW

(L. C. Card No. Mic 59-3455)

James Reese Cameron, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Warren O. Ault

In this study, Maitland's most important contributions to the history of English Law have been set forth in detail. After indicating the course and nature of Maitland's examination of the topics under consideration, the author has endeavored to explain the basis for Maitland's principal conclusions. This work then goes on to examine the writings of both those scholars who preceded and those who have succeeded Maitland in order to place his work in perspective and to determine how his contributions stand after more than half a century of historical research. Included in this work is a complete bibliography of Maitland's writings.

Maitland came to history from the study of law, and the interrelationship of these two strains permeates his writings. His legal training caused him to be suspicious of generalizations and where generalizations were necessary, he illustrated them by applying them to specific cases. Maitland had a unique ability of relating legal terms to personal experiences and meaningful patterns of thought. This method of explanation was the result of his broad knowledge of the original documents. His work as the editor of Year Books, court rolls, and Bracton's Note-Book was as notable as the volumes which he contributed on the history of English Law.

Maitland's writings are fragrant with inspiration and suggestion. His thirst for knowledge and quest for truth caused him to challenge many long-accepted facts concerning the history of English Law. He was not content to accept the conclusions of others if he had an opportunity to examine the original documents for himself. This approach to his subject caused Maitland to raise far more issues than he could hope to settle. This is the reason that Maitland's writings are still proving provocative to those who are seeking an avenue for historical exploration. He did give answers to many of the questions which he asked and this work sets forth his principal contributions to the history of English Law.

On two occasions, Maitland launched into religious controversy. While poring over the documents in an effort to determine the basis for the law regarding marriage, he became conscious of the fact that the evidence before him did not harmonize with the accepted ideas regarding the development of the Church of England. Maitland boldly challenged and successfully refuted the doctrine, held even by Bishop Stubbs, that the Church of England had a code of law distinct from that of the Church of Rome before the time of Henry VIII. Soon after this, Lord Acton asked Maitland to write an account of the Elizabethan Religious Settlement for the Cambridge Modern History. This judicious account and its by-product, the "Elizabethan Gleanings," are generally accepted by modern scholars on this subject.

Maitland was very interested in the origins of English institutions. He wrote on such topics as: the origin of the common law courts, the nature and origin of parliament, the sources of English Law, the early distinction between township and borough, and the origin of the village. Maitland must be classified with the Germanists in the conflict with the Romanists over the nature and origin of English Law and institutions. His theory for the garrisoning of Anglo-Saxon boroughs has been successfully repudiated. His Medieval Law-French dictionary was an important contribution to the editing of the Year Books. He, himself, edited four volumes of Year Books for the Selden Society of which he was a prime mover.

Though his writings are now more than half a century old, scholars still value his interpretations. Wherever and whenever the history of English Law is studied seriously, the name of Frederick William will be held in high esteem.

Microfilm $3.45; Xerox $11.60. 265 pages.

THE DEVELOPMENT OF TRANSPORTATION IN JAPAN: A CASE STUDY OF OKAYAMA HAN, 1600-1868

(L. C. Card No. Mic 59-3947)

Edwin Lowe Neville, Jr., Ph.D.
University of Michigan, 1959

This study is an analysis of the transportation and communication system in Japan during the Tokugawa period (1600-1868). It seeks to point out the main features of this system which laid the basis for Japan's modern developments in the field of transportation. The study has as its main focus a case analysis of one domain, Okayama han, which was selected for three reasons. Okayama was typical of the larger fiefs of Tokugawa Japan, it was situated astride major communication and transportation routes, and original documents of the Ikeda family, rulers of Okayama from 1632 to 1870, were available for study. Detailed data drawn from these primary sources have been used to depict the expansion of transportation and communication facilities at the local level as well as the way in which the local system was integrated into the national scene.

The first three chapters present a general description of transportation and communication in Tokugawa Japan and analyze the main periods of development. The introduction points out the significance of the Tokugawa transportation system to Japan's national development after the Restoration of 1868. The second chapter traces the expansion and improvement of the Tokugawa transportation system through its various phases of growth from its inception as a monopoly of the ruling class until the final period of joint management by the military government and the merchant class. The third chapter sets the local scene in Okayama, showing how local conditions related to the national transportation structure and how the local transportation system affected the administration and economy of the domain.

The main part of the study is comprised of a detailed account of the transportation system in the Okayama han. Since there was a clear separation of function between land and sea transport systems--travel and communications passing overland, and bulk cargoes being carried by ship --these two systems are treated separately. Chapter IV concentrates on the movement of persons. It describes the official means of controlling the movement of persons, recounts the various types of travel and analyzes the administration of the road system and their facilities. Chapter V stresses the importance of shipping in the economy of the domain and describes its administration by the domain government.

Conclusions to be drawn from this study are as follows. Transportation facilities were a major area of concern to both the national and local governments of Tokugawa Japan. Thus the improvement of transportation was actively promoted by the authorities. The growth of the transportation system followed four main periods. In the course of this growth, paramount military considerations were overridden by economic actualities. A road system came into being capable of the rapid handling of travel and communications. Sea transport of bulk cargoes developed to serve the growing cities. This, then, was the basis upon which Japan's modern transportation system was built.

Microfilm $2.45; Xerox $8.60. 187 pages.

HISTORY. MODERN

ANDRÉ TARDIEU AND FRENCH FOREIGN POLICY 1902-1919

(L. C. Card No. Mic 59-3676)

Wallace Earl Adams, Ph.D.
Stanford University, 1959

Within the political framework of the Third French Republic André Tardieu was a remarkably gifted, energetic, yet unsuccessful politician. To most observers during the interwar decades, Tardieu was the coming man who never arrived. Yet in the period before 1920 Tardieu had established a solid reputation as a brilliant student, incisive thinker, and shrewd journalistic commentator. He moved freely within diplomatic circles, praising and criticizing French foreign policy while he helped shape that policy through his newspaper columns, articles, and books. By 1919, Tardieu seemed to have fulfilled the prerequisites to a successful political career.

At the same time Tardieu early revealed personality traits which helped to create a steadily increasing reservoir of critics and political opponents. He was a man of extremes, given to viewing events as black or white and bereft of grays. He mocked and derided those who disagreed with him, and was thoroughly impatient with what he deemed to be mediocrity. Always the flamboyant egoist, he flaunted his upper-bourgeois tastes before friend or foe. Tardieu's early career indicates that he was best suited for a semi-independent role outside parliament. Generally, he was a most ineffectual politician in corridor-type French politics.

Tardieu's early career centered around journalism and the Paris newspaper Le Temps. As foreign news editor, Tardieu waged editorial campaigns on almost every vital issue involving French foreign policy and gained general recognition as the leading nongovernmental foreign affairs expert in France. Through his articles he showed himself to be an ardent patriot and a nationalist. He also demonstrated an unrelenting hostility toward the French Left, thereby arousing an animosity which plagued his entire political career.

Tardieu supported the French alliance system, though he defined it as defensive in purpose, and opposed Germany's push toward additional power and prestige. Although normally suspicious of German intentions, Tardieu did not hesitate to work for better understanding between France and Germany between 1909 and 1911, when tensions eased between the two nations. Agadir brought the era of good feeling to an end, and Tardieu remained a Germanophobe through World War I and the Paris Peace Conference of 1919.

During the war Tardieu served first at the front and then was appointed High Commissioner to the United States. He spent 1917 and 1918 helping keep materials and men flowing from the United States to France and had his first taste of personal action on a high governmental level. In most respects his mission was a personal and diplomatic success, and it led to his appointment as a member of the French delegation to the peace conference. At the conference Tradieu was the man Clemenceau trusted most, or distrusted least, and he proved to be an effective liaison agent between Clemenceau and delegates from Britain and the United States.

After the German treaty was completed, the task of defending it before the French parliament fell to Tardieu. He made a vigorous effort to convince the Chamber of Deputies that the peace treaty embodied almost perfect political justice, and by overstating his case he shadowed his own postwar political career. He was labeled Clemenceau's man, and to the extent that Tardieu bent to anyone, the label was correct. On the whole, however, Tardieu was to remain what he had been before World War I, a strong individualist with a keen but rather dogmatic mind.

Microfilm $5.80; Xerox $20.20. 455 pages.

MAINE PUBLIC LANDS 1781-1795: CLAIMS, TRESPASSERS, AND SALES

(L. C. Card No. Mic 59-3453)

Lawrence Donald Bridgham, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Robert E. Moody

In 1781 the General Court of the new State of Massachusetts launched a program for the administration of its unappropriated land in the District of Maine, a program which encompassed three main phases: the clarification of pre-Revolutionary claims, the quieting of squatters, and the sale of the land that still belonged to the Commonwealth. Fourteen years later it ended a period by ordering the Land Committee which had been appointed in 1783 to stop selling those lands. During this period the Legislature and the Committees it appointed made significant progress in each of these fields.

Despite the fact that the Province Government had devised a particularly efficient land grant system, 1781 found claims in Maine confused - authorities which controlled the area before Massachusetts bought it had not always handled these grants well, and Massachusetts itself had not followed its own system closely immediately before the Revolution. The Land Committees and the General Court settled some claim disputes during this period, but some remained to be resolved in later years. A 1791 act, not tested thoroughly before the period ended, established a method of restoring improperly claimed land to the State.

The authorities again took a moderate and lenient attitude when they tackled the problems presented by squatters. There were a number of these people on the land and they were a handicap to the Committees' attempts to settle claims and sell lands. However, realizing that these unlawful settlers had made an appreciable contribution to the Commonwealth, and sensing that the almost certain product of dispossession would be turmoil, the State at all times made plots available to them at no more than a nominal fee. During the period, the 1783 Committee provided about one thousand squatters with tracts of one hundred acres each - the tracts on which they had settled - either directly or through agreements made with proprietors. This served to forestall violence that repressive measures might easily have brought on.

The sale of land still the property of the Commonwealth was the third of the major phases of the land program; a desire to stimulate economic activity, a need to pay the public debt, a wish to speculate, and the pressure of overpopulation in settled areas were its environment. The land granting activities of the Provincial Government supplied a source of knowledge upon which the General Court drew heavily as it set up regulations to govern sales. By adhering to these regulations, the Committees succeeded in making sales characterized by definite boundary lines and clear titles. Enjoying varying degrees of success during the period, the 1783 Committee was finally selling so much land that the General Court called an abrupt halt to sales in 1795. At that time the Committee had sold or contracted to sell about four and a half million acres for a total of approximately two hundred eighty thousand pounds, Bingham's "back tract" excepted. The reasons for the stoppage of sales are not completely clear. However, an antipathy toward large holdings certainly played a part. It may be true, too, that the legislators felt that further sales would involve an unmanageable expansion of the State's responsibilities at this time.

The Court was fortunate in finding for the 1783 Committee public spirited, hard working men, who followed the prescribed procedure conscientiously. To this unit, whose sole official responsibility was the administration of the public lands, must be attributed much of the success enjoyed by the land program.

Microfilm $5.05; Xerox $16.80. 395 pages.

THE MEXICAN-UNITED STATES WAR AS SEEN BY MEXICAN INTELLECTUALS, 1846-1956

(L. C. Card No. Mic 59-3688)

Homer Campbell Chaney, Jr., Ph.D.
Stanford University, 1959

Since 1846 the Mexican intellectuals' interpretations of the Mexican-United States War have reflected closely the changing moods, convictions, and commitments of Mexico's people and government. Immediately following the disastrous defeat, there was a sense of frustration and dishonor apparent in the Mexican historical writing. In the 1850's when the Liberal mestizo-commercial element asserted itself under the leadership of Benito Juárez, the responsibility for the 1846-1848 debacle was found by that group to lie with the Conservative-Catholic-military alliance. The Conservative defense of its wartime conduct produced little more than diatribes against the United States. During the administration of Porfirio Díaz, dedicated as it was to order, unity, and progress, the historians tended to find the explanation for Mexico's defeat in the lack of social order and in the failure of public and military leaders to develop and carry out well-organized plans. Because the Díaz regime depended heavily upon United States capital for the technological development of Mexico, bitterness toward the "barbarous invaders" of the 1840's was kept to a near minimum, until the Spanish-American War caused a temporary reversion in Mexican thought to the earlier attitude of acute dislike and suspicion of the United States.

During the presidency of Álvaro Obregón, which followed the great social upheaval between 1910 and 1917, the war was increasingly interpreted in terms of the Revolutionary ideals of anti-foreignism, anticlericalism, and sympathy for the emergent working classes. The historians explained the wartime failures on the grounds that the

nation had been sacrificed in the interest of a selfish, numerically-small elite.

As a consequence of the Mexican government's successful expropriation of foreign-owned oil properties in 1938 and the strong bid for Mexican friendship made by the United States as World War II approached, feelings of national confidence during the later years of Lázaro Cárdenas' presidency replaced the earlier sense of Mexican national inferiority. Intellectual isolation, evident in Mexico since 1910, began to disappear. For the first time the Mexican historians made a distinct effort to appreciate the North American view of the war, and a closer agreement was reached between the historians of both countries on the meaning of the century-old struggle. The attitude of cooperation between Mexico and the United States which had grown up during World War II matured into an "Era of Good Feelings" that produced a new historical interpretation which removed still more of the earlier sense of bitterness toward the former enemy.

Today the articulate segments of Mexico's population believe the nation is on the threshold of magnificent achievements. The historians feel that it is futile to keep alive the antagonisms of the war, for the animosities it engenders serve only to encourage feelings of national inadequacy. Today the historians emphasize those episodes of the 1840's which tend to bolster the country's pride and justify the hope the present generation places in the future.

Microfilm $4.40; Xerox $14.80. 343 pages.

FRANK B. KELLOGG: ATTITUDES AND ASSUMPTIONS INFLUENCING HIS FOREIGN POLICY DECISIONS

(L. C. Card No. Mic 59-3776)

Charles G. Cleaver, Ph.D.
University of Minnesota, 1956

This dissertation is a study of Frank B. Kellogg's language and public record for the purpose of analyzing his attitudes and assumptions, and then relating them to four foreign policy decisions in which he participated: rejection of the League of Nations Covenant; the limitation of armament; the policy of non-recognition of Soviet Russia; and the negotiation of the "Kellogg-Briand" Peace Pact.

Publicly, Kellogg enunciated a faith in gradual but inevitable and irreversible progress; particularly, he felt, World War I had purged the world of militarism and tyranny. Countervailing tendencies of thought, however, were Kellogg's lawyer-like habit of referring present problems to precedent, and his temperamental resistance to political and economic change. Kellogg's view of history was fragmentary and patriolatrous; he was deeply committed to a work-thrift-success ethic; he was suspicious of power and "politics:" all of these habits of mind underlay a moral nationalism which frequently led him to contrast American virtue and European fractiousness and despotism. Kellogg saw the individual human being and the individual nation as unalterably separate and soverign; his sense of duty, personal and national, was circumscribed by a sense of decorum and modified by this sense of separateness. In his daily affairs, Kellogg complained that solutions to legal and political problems were evasive and complex; but he also maintained an epistemology whereby the test of truth was said to be its simplicity, clarity and popularity. Kellogg arrived at such truths as were not marked out by the natural laws codified in the Constitution and classical economics by way of an intuitionalistic notion of "reasonableness"; he was thus limited in his ability to sympathize with strange or uncommon ideas. Privately, Kellogg made empirical observations of good and evil qualities in human beings and nations; but publicly he described "the people" en masse as rational, hedonistic and peaceable. Foreigners, he assumed, aspired to be like Americans. Kellogg transferred his image of the proper public servant, which was compounded of many of the above attitudes and assumptions, to his image of the proper role for the United States to play in the world community.

Kellogg was a "mild reservationist" during the League debate. Being a Senator and a Republican were apparently more decisive to his position at that time than the attitudes and assumptions described above; but he evoked his faith in progress and his sense of personal and national duty whenever he defended Wilson's League, and his chauvinism, xenophobia, and atomic nationalism whenever he attacked it; moreover, his position at that time reflected his faith in "reasonableness." His argument for the limitation of armaments reflected his faith in progress, his hostility to European militarism and wastefulness, and his pride in American peacefulness, but it did not penetrate his nationalism. The United States, he said, promoted limitation for moral reasons, to help the "outside world." Russia before Bolshevism was to Kellogg a symbol of the worst of foreign tyranny, superstition and militarism; but Bolshevism violated nearly every tenet of his political and economic orthodoxy; so there was an intense emotional dimension to his rationale of non-recognition of Soviet Russia. The "Kellogg-Briand" Pact embodied many elements of that orthodoxy: faith in natural law, the power of rational and peaceable public opinion, and American leadership in the progress of the world toward peace.

An appendix to this dissertation contains the suggestion that a thorough study of the language and public records of Elihu Root, Charles Evans Hughes and Nicholas Murray Butler might reveal what a casual study indicates: that they shared quite fully the attitudes and assumptions attributed here to Kellogg.

Microfilm $5.30; Xerox $18.60. 415 pages.

PROTESTANTISM AND THE PRINTING WORKERS OF LYONS: A STUDY IN THE PROBLEM OF RELIGION AND SOCIAL CLASS DURING THE REFORMATION

(L. C. Card No. Mic 59-3971)

Natalie Ann Zemon Davis, Ph.D.
University of Michigan, 1959

This is a case study on the following problem: Was adherence to Protestantism in sixteenth century France determined by class position or by economic and political aspirations? Lyons was chosen as a commercial and industrial center with varied economic types. The printers' journeymen were studied in detail because their industry was capitalistically organized and they expressed much economic dissatisfaction.

The classes in Lyons are found to have been: an urban patriciate of the very rich, ennobled through membership on the Consulate, but living as merchants or industrialists; a middle class of well-off merchants and a few master craftsmen; and the "little people"-- an upper stratum of petty merchants and master craftsmen, and a lower stratum of journeymen and unskilled workers. Careful search of records revealed the names of 1301 male Protestants in sixteenth century Lyons; the class distribution proves to be roughly the same as that of the total population.

Similar non-correlation is shown in more detail in the printing industry. The dissertation traces the stages in the growth of interest in Protestantism among rich publishers, master printers, and poor journeymen; and the journeymen's eventual disenchantment with the Reformed Church and return to a moderate Catholicism. During the same years there were bitter strikes and litigation in the industry. It is demonstrated, however, that economic opponents were often religious allies; Catholic and Protestant journeymen were united against a coalition of Catholic and Protestant masters, publishers, and town officials.

The explanation for the lack of determination of religious choice by economic and political factors is sought in the secularization of political and economic life in Lyons. The economic relations of the Lyons Catholic Church and the traditions of the city are shown to be such as to lead people there to treat political and economic problems in naturalistic rather than religious terms. For instance, the Church's material interests played no direct part in causing the poor wages and working conditions which dissatisfied the printers' journeymen; they blamed these on the masters and booksellers, and attempted to correct them by agitating for better edicts.

This does not mean that the people of Lyons did not care deeply about religion, but that they relate it primarily to such things as sense-life, family relations, and feelings of pride and guilt. Where political and economic problems were being treated in a direct secular way, other factors determined religious choice.

What these other factors are is suggested by the vocational distribution of Lyons Protestants. Men in occupations with certain intrinsic satisfactions (skill, novelty, social value of the product) were especially attracted to Protestantism, whether they were merchant-industrialists or journeymen. Printers and goldsmiths were more likely to become Protestants than butchers and masons. In particular the religious choices of the printers' journeymen are analyzed in terms of vocational traits established from contemporary sources. For instance, their relative literacy and occupational pride encouraged them to challenge clerical monopoly on understanding religion. Their need for religious fellowship, which they hoped to satisfy in Protestantism, may be partly explained by the fact that many of them had cut geographical and vocational ties with their families to enter this new industry. Similarly, sources are suggested for their strong concern for sensuous experience, which worked for their return to the Catholic Church of the Counter-Reformation.

It is concluded that secularization is an important variable to consider in analyzing the relation between religion and social class. In traditional rural communities and towns with less secularization than Lyons, economic and political factors may have had more determining relevance than in Lyons. In any case, the examination of vocational traits is a fruitful approach in understanding the rise of French Protestantism.

Microfilm $7.90; Xerox $27.00. 621 pages.

THE REMOVAL OF THE CHOCTAW INDIANS FROM MISSISSIPPI

(L. C. Card No. Mic 59-3489)

Arthur H. DeRosier, Jr., Ph.D.
University of South Carolina, 1959

In the period from 1818 to 1834, the Choctaw Indians were moved from the state of Mississippi to the Indian Territory. In the overall picture of American history, the removal of one nation of aborigines, amounting to no more than twenty thousand people, seems rather trivial when compared with many of the other events of the nationalistic period. This is not true, though, for the handling of the Choctaw problem by the federal government eventually affected the very existence of almost every Indian nation in the country. The Choctaw were chosen as the experimental nation where all major Indian removal policies sponsored by the missionaries, the philanthropists, and the militant West could be tested by the War Department. Other nations could have been chosen for the experiment, but the Choctaw possessed more of the necessary qualifications. The War Department wanted to experiment with a large, civilized, friendly, stationary nation, which eliminated all of the Indian nations except the Cherokee and Choctaw. Either of these would have been accepted as a representative tribe, but the Choctaw were further West and had fewer dealings with the white man. Therefore, the Choctaw removal does not gain its importance from the fact that it was the first major removal effort, but because it established the basic Indian removal policy of the nineteenth century.

The major Indian policies that vied for acceptance by the federal government were sponsored by John C. Calhoun and Andrew Jackson. Calhoun, during the period 1818-1825, was the avowed champion of the policy of moderation. He foresaw the eventual removal of the Indians to the West, but he would allow them to determine for themselves when they would undertake to emigrate to new lands offered in trade by the United States government. The only way that Calhoun tried to prod the Indians into removing as soon as possible was through a system of education that would teach them the necessity of removal. The result of Calhoun's policy was the Treaty of Doak's Stand, signed on October 18, 1820, which ceded to the United States 5,169,788 acres of land in southwestern Mississippi. The treaty was important for, despite the fact that most of the Indians affected by the treaty refused to emigrate West, it was an honest effort to solve the thorny Indian problem by honest negotiations between equals.

Jackson, on the other hand, did not believe in moderation. He felt that Calhoun was a hypocrite for defending the Indians against the frontiersman, and at the same time preaching eventual removal. Jackson's philosophy was simple and represented the feelings of the West. The Indians must immediately emigrate West, or the armed might of the federal government would force them to move

or would annihilate them. It made no difference to the frontier general how the Indians moved, voluntarily or by force, for he was always ready for a good scrap. It was this idea that Jackson carried with him from the Hermitage to the White House, and put into operation in 1829 with the assistance of his western friends. The inevitable result was the notorious Treaty of Dancing Rabbit Creek, signed on September 27, 1830, which forced the Choctaw to cede all of their remaining lands in Mississippi.

This study of the removal of the Choctaw Indians from Mississippi discusses all of the negotiations leading to the above mentioned treaties, and tries to show the evolution of America's Indian policy from one of fairness to one of forced obedience to the will of the frontier settlers. This study also discusses the actual removals of the Indians to the Indian Territory in 1831, 1832, and 1833, and concludes with the actual settlement of the Choctaw on their new lands in the Indian Territory.

Microfilm $3.45; Xerox $11.80. 270 pages.

GUSTAV STRESEMANN AND THE GREATER GERMANY, 1914-1918.

(L. C. Card No. Mic 59-4065)

Marvin L. Edwards, Ph.D.
Columbia University, 1959

This study provides an integrated account of Stresemann's ideas and activities as an annexationist during the Great War and examines his political ideas during the same period. It is based primarily on the Stresemann Nachlass, heretofore unexploited for the war period.

Influenced strongly by Bulow and Bassermann, Stresemann criticized Germany's pre-war diplomacy as "weak" and would not have been averse to a greater readiness to use the threat of force in support of German diplomacy. There is, however, no evidence that he desired the war, which he blamed on England's jealousy of Germany's growing economic might, and he remained a strong opponent of the charges of German war guilt.

The annexationist program for a Greater Germany which Stresemann shared with industrialists and Pan-Germans, would have entailed German political hegemony in Europe and also envisioned both territorial gains and economic expansion. Stresemann stressed the domination of Belgium to guarantee German access to the sea, assuring thereby the fulfillment of Germany's economic aspirations and the return and expansion of the German Empire overseas. Stresemann helped formulate this program, particularly through the Six Great Economic Organizations, and was one of the leading annexationist speakers and pamphleteers. His aim was to force the Government to move from its defensive stand of August, 1914, to a positive commitment to the annexationist program.

Stresemann's annexationist goals determined his espousal of unrestricted submarine warfare as the means to achieve them. Rather than the gullible victim of Naval propaganda, Stresemann, aware of the limited number of submarines, was himself instrumental in deceiving the public in order to exert pressure on the Government for their unrestrained use. Influenced by hatred and fear of England, he erred in appraising the effects of submarine warfare on England and erred again in completely discounting the economic potential of the United States despite his own economic experience and pre-war American business ties.

Both before and during the war Stresemann showed little understanding of diplomacy. His annexationist program, based on complete faith in Germany's military might and military leadership, precluded a negotiated peace. Disclosure of Germany's impending defeat in the late summer of 1918 came to Stresemann as a complete shock. Only in the shadow of defeat did he seem to grasp something of the art and nature of diplomacy.

Stresemann blamed Chancellor Bethmann-Hollweg for the failure of Germany's diplomacy, for the delay in the unrestricted use of the submarines, and for the resistance to official commitment to the Greater Germany. He became the willing instrument of General Ludendorff in forcing Bethmann's resignation during the July Crisis of 1917, Stresemann's most significant action during the war. He skillfully diverted a crisis which threatened the war aims program into a Chancellor crisis which thwarted the aims of the moderates and then helped to nullify Erzberger's Peace Resolution.

In these events, and even earlier in the crisis over internal reforms which had led to the Emperor's Easter Message of April, 1917, Stresemann had disclosed skill as a political tactician. His opportunism, involving dubious ethics in support of sincerely patriotic if chauvinistic aims, his adaptability without losing sight of his main goals, together with a strong personal ambition for office, made it possible for him to adjust successfully to the change from Empire to Republic.

Microfilm $3.35; Xerox $11.40. 258 pages.

FROM WILDERNESS TO WORKSHOP: THE RESPONSE OF FOREIGN OBSERVERS TO AMERICAN INDUSTRIALIZATION, 1830-1860

(L. C. Card No. Mic 59-3778)

Marvin Mark Fisher, Ph.D.
University of Minnesota, 1958

Even before the Civil War, European observers, who naturally noted what seemed unusual or exceptional, were amazed at the unexpected sight of American industrialization and its unique features. Their accounts point unmistakeably to the importance of industrialization in mid-nineteenth-century America.

Firmly convinced that America offered freedom and opportunity based on the availability of free land, many Europeans, nevertheless, discovered that industrialization was a social force no less remarkable or influential than the frontier. The dramatic transition from wilderness to workshop impressed Europeans in several ways. In a setting of abundant natural resources, American industry appeared essentially rural and unscarred. Relatively high wages, good working conditions, and the personal concern of paternalistic employers made American workers seem remarkably fortunate. Education and social mobility further differentiated American workers and made possible a degree of independence unknown in Europe. Here progress had assumed a more tangible social dimension and affected the whole society.

The newness of the country seemed to make Americans less dependent on traditional methods. Concern with practical applications permeated all categories of thought. The Europeans' image of America depicted an entire nation free of class restrictions and religiously dedicated to change, mobility, improvement, and profit. The average American seemed an unusually talented mechanic whose inventive abilities and practical attitude fashioned a productive system distinguished by unprecedented rate of growth and technical innovation. Americans were a "go-ahead" people in a "go-ahead" land.

Visitors discerned a pattern of manufacturing notable for its methods of production and distribution -- a pattern usually associated with contemporary America. They marveled at the Americans' striving for new, more efficient production methods, the ease with which improvements were adapted from one industry to another, and increasing substitution of machine for human labor. Coupled with a revolution in transportation and communication, manufacturing was no longer localized in the North and East but spread to the Middle Atlantic states and to parts of the West and South. Almost all foreign observers concluded that this unprecedented industrial progress presaged exceptional material and social betterment. Here was a source of opportunity and stimulus to democracy to rival the frontier long before free land had disappeared.

Europeans also felt that industrialization unified the political and economic interests of the nation. Railroads reduced the distance between different places, and between classes. Transportation improvements enabled sectional specialization and national distribution. Eliminating the barriers of space and time, this technological development brought closer the goals of democracy and influenced national destiny. More than most Americans, these Europeans perceived the growing industrial supremacy of the United States, and using technological progress as an index of greatness, they predicted the growing influence of America in world affairs.

But admiration for industrialization was not unanimous. Occasional expressions revealed undertones of fear and doubt -- sometimes even in the writings of admiring observers. Because industrialization was new in America, some cautiously withheld final judgment. Others perceived features which might possibly parallel unhappy European experience. These scattered reservations, however, lacked the coherence of the dominant response. Only Tocqueville's reasoned critique of industrialization challenged the idea of progress and anticipated the aesthetic, economic, physical, psychological, and political dangers of large-scale industrialization. Standardization in manufacturing, he insisted, reinforced the general trend toward conformity, debased individual tastes and aspirations, and hastened the drift toward a bureaucratic welfare state.

To an amazing degree, these responses seem to prefigure the contemporary image of an industrial system capable of boundless promise but not without inherent dangers. But unlike today when the vastly accelerated pace of change and tremendous advance in military technology challenge the most sanguine, nineteenth century America presented reasons for optimism.

Microfilm $3.70; Xerox $12.60. 287 pages.

F. LAURISTON BULLARD AS A LINCOLN SCHOLAR

(L. C. Card No. Mic 59-3461)

Joseph George, Jr., Ph.D.
Boston University Graduate School, 1959

Major Professor: Kenneth A. Bernard

F. Lauriston Bullard (1866-1952), for forty years a student of the life of Abraham Lincoln, came to be regarded as an outstanding Lincoln scholar.

Born in Wauseon, Ohio, Bullard attended Wooster College, Ohio, and was graduated in 1891. After further study at Yale University Divinity School, followed by fourteen years in the ministry, Bullard, in 1907, entered the field of journalism. In 1915 he was appointed an editor of the Boston Herald, and four years later was named chief editorial writer of the Herald.

Influenced by his friend, James F. Rhodes (who attached great importance to Lincoln's life), and also by a volume of Lincoln's writings, Bullard began his career as a Lincoln scholar in 1909. In this year he had two articles published, one emphasizing Lincoln as a religious man, and the other dealing with Lincoln's New England ancestry. The latter included a previously unpublished Lincoln letter illustrating the Sixteenth President's interest in his ancestry.

From 1909 until 1938, Bullard did not publish many works on Lincoln. But, from 1938 until his death in 1952, Bullard's work gained him a wide reputation as a severe critic of inaccurate works on Lincoln and as a specialist interested in Lincoln's career.

As a critic Bullard reprimanded Emanuel Hertz for faulty editorial work in his publication of papers in the Herndon Collection, and he demonstrated that Carl Sandburg had incorporated material of doubtful value in his Abraham Lincoln: The War Years.

Most of Bullard's writings dealt with brief, isolated incidents relating to the life of Lincoln, but there were a few items that commanded his attention almost continuously from the beginning to the end of his career. The report of Adelina Patti singing for the Lincolns in the White House is one such report. Bullard was able to prove the story false. Another was the report that John Wilkes Booth was in Paris in 1864 or early 1865. Bullard concluded that Booth was probably in Paris, but in 1863.

While most of his writings appeared in magazine articles, numbering fifty in all, Bullard also published four books on Lincoln that are of some importance. Tad and His Father (1915) is the first work in the field dealing with Lincoln's sons; "A Few Appropriate Remarks:" Lincoln's Gettysburg Address (1944) presents an account of how the speech was written and received; Lincoln and the Widow Bixby (1946) offers a strong case for the authenticity of the Bixby Letters; and Lincoln in Marble and Bronze (1952) describes eighty-seven statues of heroic size.

Bullard's vast knowledge of the Lincoln field was based primarily on his magnificent Lincoln Collection. This Collection, accumulated during his lifetime, consists of one hundred and thirty-one notebooks filled with clippings and twenty-five hundred books, and countless letters from scholars and students, all dealing with the Civil War and Lincoln.

Bullard's reputation does not rest exclusively on the many incidents in the career of the Sixteenth President

that he uncovered. As a result of his forty years of study in the field, Bullard was able to see the real Lincoln--the Lincoln with weeknesses, but the Lincoln who nevertheless remains as one of the outstanding figures in American History.

His thoroughness as a Lincoln scholar earned Bullard the acclaim of his fellow workers in the Lincoln field. Paul M. Angle's estimate of Bullard's work provides a fitting conclusion:: "Too often training in journalism, with its insistence upon quick results, leads to hasty work when the journalist becomes historian. Emphatically, this was not Bullard's way."

Microfilm $3.70; Xerox $12.60. 288 pages.

SOCIAL AND ECONOMIC STRUCTURE AND DEPRESSION: AMERICAN LABOR IN 1873 AND 1874

(L. C. Card No. Mic 59-3437)

Herbert George Gutman, Ph.D.
University of Wisconsin, 1959

Supervisor: Professor Howard K. Beale

This study stresses relatively unexplored aspects of the local economic and social structure that help explain the behavior and outlook of American workers and employers during the 1873-1879 depression.

Part One, in treating industrial workers and entrepreneurs in small towns and in focusing on eighteen railroad strikes, an Ohio Valley iron strike, and four coal strikes and lockouts in Pennsylvanis, Ohio, and Illinois, challenges the view that post-Civil War industrialists had almost unlimited power in dealing with workers. Exploring social relations when industrial capitalism was not yet fully institutionalized, the chapters in Part One suggest the need to modify traditional notions that labor was "isolated" and employers had a relatively "free hand," that the "spirit" of the Gilded Age worked to the employers' advantage for workers found little sympathy from non-workers, and that industrialists, therefore, easily swept aside numerous obstacles. In recent years, historians have stressed the importance of entrepreneurship in nineteenth century America. What must be emphasized, however, is the distinction between entrepreneurs in commerce and trade and those in industrial manufacturing. Much of the antipathy toward industrialists in the Gilded Age came from persons that accepted entrepreneurship, but, for one reason or another, would not go along with the social consequences of industrialism and the decisions industrialists made to better their competitive position or to cheapen productive methods. In this light, the behavior of industrialists, the extended duration of many strikes and lockouts, and the character of industrial conflicts in the 1870's becomes more understandable. The decisions industrialists made and, especially, their frequent pleas for outside help often were alternatives forced upon them by their weakness.

Part Two studies the economic and social structure of the urban working population. Most labor historians have stressed the "craft" workers and their response to the changing economic environment, but these pages emphasize the industrial worker, show that the "factory system" already involved a majority of urban workers by 1873, and that the uneven manner in which manufacturers adopted technological innovations shaped a heterogeneous labor force. Such questions as the size of the labor force in different factories within the same industry and the absence of perfect competition are examined. Consideration of the social composition of the urban wage-earning class suggests that the distribution of so-called "old immigrants" shaped the irregular, heterogeneous, and "modern" structure of the urban labor market before the coming of "new immigrants." An examination of working conditions relates such matters as wage rates, hours of work, piece rates and incentive payments, and seasonal work to the process of capital accumulation in a time of fierce competition when employers gained by cheapening production.

Part Three considers the demand for public works in some large cities during the early months of the 1873 depression. The sources reveal that labor historians have overemphasized the role of immigrant socialists in the movement, for they show that Greenbackers, anti-monopolists, craft unionists, and ex-socialists dominated and shaped the agitation everywhere except Chicago. A consideration of the background and aftermath of the famous Tompkins Square "riot," finally, inquires into the reasons for the rapid collapse of a seemingly popular social movement and evaluates the responses of the community-at-large to the "unemployed movement" and to the "riot."

By giving attention to the normal rather than to the unique and showing more interest in the context than in the event, this study emphasizes how the economic and social structure of the 1870's shaped the behavior of workers and employers. In this way, the industrial history of the post-Civil War decades becomes more meaningful.

Microfilm $5.80; Xerox $20.20. 453 pages.

A CENTURY OF AMERICAN CONTRIBUTION TO ARAB NATIONALISM, 1820-1920

(L. C. Card No. Mic 59-852)

Muhyee Al-Din Hatoor Al-Khalidi, Ph.D.
Vanderbilt University, 1958

Supervisor: Harold W. Bradley

The century between 1820 and 1920 witnessed the development of Arab nationalism. This nationalism started as a literary renaissance, and the national and political aspirations, which came to characterize it in the last part of the nineteenth and the first part of the twentieth century, were in the first instance an expression of this intellectual awakening. The intellectual awakening began under the impact of influences coming from the west, influences which from the beginning have come in two quite different forms—one peaceful, non-political, and sympathetic; the other political, backed by force or the threat of force, and indifferent to the culture or aspirations of the Arabs. Both these kinds of influences, however, played their part in reviving the Arab mind, which as a result became increasingly aware of the existence and the reality of the Arab community as a homogenous whole, intact and capable of being reanimated by the twofold inspiration of its

own past and the message of western civilization. The intellectual awakening thus led to a revival of national consciousness, and this consciousness gradually began to express itself in political terms—a desire for freedom from foreign rule.

The object of this dissertation was to explore, within the context of the history of the region and the evolving pattern of European diplomatic and power rivalry, American contribution to this national consciousness. The dissertation is based on a wide range of sources including manuscript, public documents, newspapers, memoirs, books, and periodicals.

Chapter I of the study, "Background of American-Turkish Relations," reviewed early American contacts with North Africa and Turkey. Particular emphasis placed on the attempts of the United States to acquire, capitulatory rights from the Turks. Such rights were secured by the Treaty of May 1830.

Chapter II, "The Era of Capitulation," emphasized the commercial relations of the United States and Turkey. The purpose of this emphasis was to determine the cultural values which might have been communicated to Arab society through this channel. The result, however, was disappointing. American trade with Turkey not only was confined to the seacoasts of the Empire, but, owing to certain factors, and in particular British competition, was very limited.

The highlight of American contribution to Arab awakening, therefore, had to come through another channel, the educational. In this, American Protestant missionaries, as revealed in Chapter III, "The American Missionaries and the Reawakening of Arab Nationalism," played a significant role. Those missionaries came to the Levant as early as 1820, and in a course of time they brought great changes to the cultural life of a hitherto stagnant Near East. By 1834 the American Syrian Mission had an Arabic press in Beirut which was to prove of immense value in facilitating educational work in the whole area. Because of its primary emphasis on native traditions and culture, this American religious-educational enterprise bore unexpectedly rich fruit. Since it was free from any political taint, it came to enjoy a reputation and a response which the concurrent, and competing French effort could not bring forth. Steady educational progress was crowned in 1866 by the opening in Beirut of the Syrian Protestant College, which in 1920 attained the status of a general and justly celebrated university. The part which this institution had played and is still playing in raising the level of Arab culture and national activities, thanks both to its direct impact on the students and the subsequent influence of its graduate, was remarkable.

The non-political, educational, and sympathetic influences of American missionaries and educators were, simultaneously, encountering political influences or a desire for conquest and domination. Since Napoleon's invasion of Egypt in 1798, the Ottoman Empire had become the pawn of European power politics. The Arab World, as Chapter IV, "Western Interests and Arab Nationalism," explained, found itself involved in the process but had no voice in the matter. Throughout the nineteenth century that world was the object of piecemeal and wary penetration by European Powers; concerted conquest had to wait the right opportunity. The eruption of the First World War furnished this opportunity. In October 1914 Turkey entered the war on the side of the Central Powers, and once it did so Great Britain and France hastened to implement their century-old designs in the Arab countries. To be sure, certain Arab classes assisted directly and indirectly in the ultimate success of these designs. Chapter V, "The Arab Revolt," was designed to support this assumption.

In the long process of disintegration imposed on the Ottoman Empire by the European Powers the United States played no part. It possessed no political interest in that Empire, and what is more, was still adhering to its non-interference policy in the political affairs of the Old World. Its contribution to Arab nationalism through this negative channel therefore was of no significance.

The concluding chapter, "Arab Nationalism and the Disappointing Peace," was devoted to the peace settlement. In this connection particular emphasis placed on the efforts of President Wilson, who, although committed himself unreservedly to the principle of establishing a national home for the Jews in Palestine, endeavored to gratify the aspirations of Arab nationalism. His efforts in this regard were unsuccessful. The findings and recommendations of the King-Crane Commission which he sent in July 1918 to the Near East to assertain the wishes of the Arabs concerning the future of their countries, owing to Anglo-French and Zionist pressure, were suppressed. The final settlement, accordingly, was left in the hands of Great Britain and France, which in the San Remo Conference of April 1920 divided the Arab countries between themselves. With that the Arab World entered a new era, during which internal as well as external forces conspired to promote localism at the expense of nationalism. In a politically divided world, this localism has acquired with the passage of time certain realities and left permanent and injurious marks on the Arab World which have yet to wear off.

Microfilm $5.10; Xerox $17.00. 399 pages.

THE STORY OF HEMP IN COLONIAL VIRGINIA

(L. C. Card No. Mic 59-4229)

George Melvin Herndon, Ph.D.
University of Virginia, 1959

The following outline indicates the nature of the contents and major topics discussed in this manuscript:

The First Century: The Search for a New Staple
The Beginnings of Success, 1703-1764
Management of the Crop
Marketing the Hemp
Production, Prices and Exports, 1764-1783
The Manufacture of Hemp
The Role of Hemp in the Revolution
The Decline

Hemp (cannabis sativa) is not native to any part of the Americas. It was first introduced in Virginia in 1611 by Sir Thomas Dale and Virginia planters experimented with its production for about 150 years before it became a commercial staple.

An appreciable amount was being grown by the 1730's, but few planters were interested in hemp as a staple for export. Most of Virginia's hemp was consumed domestically. In the period 1765-1783 a great deal was produced, though it became a major staple in only one area--the

Valley of Virginia; however, a considerable amount was produced in Piedmont. During and immediately following the Revolution Tidewater grew hemp in quantity. By the end of the colonial period Virginia was producing about 5000 tons annually. Approximately 1000 tons was exported, the remainder was worked up and consumed in the colony.

Pre-Revolutionary inventories and accounts indicate that most families owned equipment for spinning and weaving and also for rope making. During the war many ropewalks were erected--at least twnety were in operation at one time or another during the period 1775-1783. Sail duck was manufactured in Alexandria, at Four Mile Creek (below Richmond), Fredericksburg, Norfolk, Portsmouth and Richmond. There were hemp and flax factories making cloth in Fredericksburg, Henrico, Williamsburg and Winchester.

Virginia was the largest producer of hemp during the Revolution and Virginia hemp played a vital role during the war. The Continental Army and Navy were supplied with a considerable amount of cordage and sail duch manufactured in the state as well as its own militia and navy--much of it produced at the state-owned ropewalk and sail duck factory. Military stores for Continental and Virginia troops were frequently purchased at Philadelphia with Virginia hemp. At times hemp was preferable to tobacco in payment for such supplies.

The end of the war and independence for the American colonies witnessed a rapid decline for the Virginia hemp industry. At the cessation of hostilities the State of Virginia (the largest wartime purchaser), stopped buying hemp. There was at the same time an increase in the production and use of cotton. Virginia hemp could not compete with Russian hemp despite the tariff, and there was a tremendous increase in the production of superior and cheaper hemp in the fertile limestone regions of Kentucky. The death of the Virginia hemp industry was inevitable. Microfilm $2.70; Xerox $9.40. 208 pages.

RATIONALE FOR AN INDUSTRIAL SOCIETY

(L. C. Card No. Mic 59-3750)

John Hove, Jr., Ph.D.
University of Minnesota, 1959

If a tradition is a continuity in thought, a recurrence of certain familiar attitudes, and an affirmation of similar values, there is an American intellectual tradition closely linked to an awareness of the potentialities and values of machine technology. This study is an examination of the writing of four proponents of industrial technology--Alexander Hamilton (1757-1804), Thomas Ewbank (1792-1870), Frederick W. Taylor (1856-1915), and Thorstein Veblen (1857-1929)--and includes as basic source material Hamilton's Report on Manufactures, Ewbank's The World a Workshop, Taylor's Scientific Management, and Veblen's principal works, particularly his Instinct of Workmanship.

The most frequently recurring attitude in the rationale is an unqualified affirmation of maximum production. To all the proponents, maximum production means more than plenty, comfort and leisure and the concomitant values of standardization, economy, and efficiency, though it means all these things, of course. More important it means harmony and progress. To achieve these benefits, all the proponents emphasize the virture of work and accept the necessity of greater physical effort--if not outright exploitation of the laborer--at least until machines, the prime movers and the prime civilizers, relieve man from burdensome toil. Hence they would approve of automation, the logical development of mechanization.

Not only do these benefits of maximum production justify the division of labor, but the proponents see in the division of labor a growing and desirable interdependency unifying all men in a system of harmonious group life with the machine process or the asembly line becoming the archetype of social and industrial life. Each recognizes the necessity of curbing reckless or willful individualism so that the machine process can operate at maximum capacity. They advocate a realistic adaptation of work and materials to the demands of the machine. Such adaptation does not mean painful regimentation; it means greater individual--in fact, democratic--opportunity for man. To hasten the harmonious adjustment of men and materials to the processes of machine production, Hamilton and Veblen recommend the use of federal power; the others, a rational understanding of what is. All of them agree that rational planning is necessary; they condemn laissez-faire policies particularly when they are followed in an attempt to solve problems of production. The submergence of what is only a present but short-sighted and selfish personal advantage is a necessary and a not too unfortunate consequence of such detailed planning.

In endorsing the division of labor, these writers necessarily condemn the self-sufficient and isolated craftsman and the values inherent in handicraftsmanship as well as the values and meanings conventionally associated with the fine arts as opposed to those of the industrial arts. They share a pronounced anti-agrarian bias and emphasize science and the values thought to be inherent in science and the scientific method.

To say that there is an American intellectual tradition closely linked to an awareness of the potentialities and values of machine technology does not mean that this tradition has in fact determined behavior generally or that it has shaped the direction of technological development in this country. It does perhaps give an insight into the large question of which values and meanings an industrial society --as compared to others--tends to give prominence and helps us to understand and appreciate what it means to live in a machine civilization. A critical evaluation of the possibilities of a technological society as delineated by this rationale can help us accept the significance of one of the most obvious American accomplishments--the ability to produce machine-made goods abundantly.

Microfilm $2.75; Xerox $9.60. 211 pages.

GOVERNMENT REGULATION OF BUSINESS ENTERPRISE IN VIRGINIA, 1750-1820

(L. C. Card No. Mic 59-3779)

Robert Johnson, Ph.D.
University of Minnesota, 1958

This thesis traces the development of governmental-economic relationships through seventy years of Virginia

history, comprising three political periods: the colonial, the confederational, and the federal. It essays, therefore, to analyze both the institutional and the dynamic aspects of the story; in the first case, the organization, financing, and supervision of economic affairs; and in the second, the crucial changes as well as the continuities which co-existed throughout the area.

The first two chapters are devoted to an analysis of the tobacco economy, the development of the inspection system, and a detailed description of its organization and functioning. Chapter 3 discusses the general pattern of regulation in the colony, seeking to show the relative importance of other forms of enterprise than tobacco, and the extension of regulatory models from the tobacco business to these ventures.

The fourth, fifth, and sixth chapters attend to the great issues which led to the Revolution. They are presumed to have been, basically, the problems of money, exchange, debts, and lands. Each is examined in terms of the competing or conflicting interests involved - British and colonial, governments, merchants, speculators, and planters - and the evolution of each is followed to the point of crisis. This section comes to a climactic close with the Revolution, although Chapter 5, dealing mainly with merchant-planter debts, is carried to 1800, ending more logically with a study of the debt causes of 1789-1804.

Chapter 6 explores the period, 1776-1789, and is organized into six topics, (1) the use of the opportunity afforded planters to rid themselves of their financial obligations, (2) the economic aspects of Virginia's conduct of the war with emphasis on the role of the state as entrepreneur, (3) state encouragement of business enterprise, (4) the search for new commercial relationships, (5) the financial problem of the state, and (6) the impact of the federal system upon Virginia's economic policy. The state effort is assessed and evaluated with respect to the aims of the Virginia leadership.

Chapter 8 conceives of the first twenty years of the nineteenth century as a period of transition - no longer characteristically eighteenth century and not yet fully nineteenth. The transitional nature of the period is suggested by prefacing its analysis with a summarization of the eighteenth in terms of the three-fold "Heaton formula:" "organization, financing, regulation." The summary is followed by a scrutiny of the dynamic elements in the nineteenth century economy: (1) the rise of the cities, (2) the rise of the merchants, and (3) the rise of the West. The problems and conflicts entailed by these changes are examined.

The chapter now takes up the organization of the economy, emphasizing the corporation as the new characteristic form of enterprise, but discussing also such models as household industries, merchandising houses, factories, etc.. Next is an analysis of the financial aspects of the economy, especially the rise and role of banking and insurance institutions, and the formation and sources of capital. Finally, this analysis turns to nineteenth century regulation. Since the general eighteenth century pattern persisted here, attention is focussed on city regulation, tobacco, wheat, and finance, where new elements require recounting. This discussion is related always to the changes described in the second section of the chapter.

The thesis concludes in a brief essay on the decline of Virginia from her preeminent eighteenth century status, and suggests some explanations from her economic history. Microfilm $5.65; Xerox $19.80. 441 pages.

THE EARLY LIFE AND THOUGHT OF KITA IKKI.

(L. C. Card No. Mic 59-3713)

Harris Inwood Martin, Ph.D.
Stanford University, 1959

Kita Ikki (1883-1937), an important figure in the ultranationalist movement of prewar Japan, is well-known for the part he played in the Chinese revolution, in the formation of ultranationalist societies in the nineteen twenties, and in relation to the Young Officer Movement of the thirties. But western scholars have been largely uniformed concerning his youth and the first of three books that he wrote, a book which he himself regarded as the ideological base for his subsequent thought and activity.

This study is a description of Kita Ikki in his "formative years," and an attempt to place him and his thought as expressed in his first book, entitled Kokutairon oyobi junsei shakaishugi (Theory of the national structure and pure socialism), in the perspective of rapidly changing Japan at the turn of the twentieth century.

Kita's keen and searching mind led him to question the content and the suitability of the orthodox views of the Japanese state, emperor, and national history which were officially propagated in the Meiji constitution, the national educational policy, and the revival of the national Shinto cult. These views, collectively designated kokutairon (theory of the national structure), he attacked vigorously as an instrument employed by the new capitalist overlords of Japan and their political henchmen to frustrate and suppress the legitimate role and aspirations of the Japanese people, so recently emancipated from feudal subordination. Kokutairon, he argued, was not based upon a rational and evolutionary interpretation of Japan's history, but upon myth, and was an emotionally charged "reverse movement criticism" which misinterpreted the past and misinformed the people, forcing them to become aware of superstition.

To take the place of the false views of Kokutairon, Kita offered his own interpretation of the nature of the Japanese state and its history. A confirmed evolutionist and a Marxist in his way, Kita swept aside the orthodox myth and attempted to show that Japanese society, like all societies, developed according to an evolutionary pattern in which the successive stages of political consciousness and legal and ethical ideals were determined by the gradually developing and changing economic structure. While Kita drew liberally from the classical economists and from Marx, he was more of a romantic, and ascribed a major directive role to ideals in the course of evolutionary change.

Kita's interpretation of Japanese history led him to a remarkable conclusion that Japan's constitutional structure was that of a "citizen state," withheld from the ultimate goal of "Social Democracy" only by the influence of the powerful but anachronistic "economic aristocracy" which must be removed by a new revolution just as the feudal aristocracy was removed by the Restoration "revolution."

This study suggests some hypotheses regarding Kita's motivation. He is seen as a symbol of the "new" Japan denied expression by the residue of the "old." Some attitudes which pointed to his later identification with the ultranationalist movement are discussed, but no attempt is made to analyze the obviously profound changes which set the course of his later career. Rather, the product of his youth is measured against the period of his youth, and it is concluded that despite apparent limitations, he was among

the few Japanese of the Meiji period who possessed unusual insight into the nature of the great changes facing Japan.
Microfilm $3.05; Xerox $10.60. 236 pages.

NEGRO SLAVERY IN NEW YORK

(L. C. Card No. Mic 59-4077)

Edgar J. McManus, Ph.D.
Columbia University, 1959

Negro slavery was more important in colonial New York than in any of the northern colonies. Negro slaves were introduced in 1626 by the Dutch West India Company in order to stimulate New Netherland agriculture. The first slaves arrived at a time when the colony had little need for slave labor. The early economy of New Netherland was largely extractive and relatively unfavorable to slavery. Dutch settlers engaged in fishing or in the fur trade had little use for the services of slaves. The first slaves remained with the West India Company. They provided most of the labor for the Company's bouweries where food was produced for the New Netherland garrison.

The decline of the fur trade after 1640 canalized Dutch settlers into agriculture. The new importance of agriculture in turn stimulated a demand for slaves. Slaves were particularly needed on the Hudson Valley estates where they performed labor for which free workers were scarce or unobtainable. The entrenchment of slavery in New Netherland was promoted by a steady flow of immigration from New England. Slaves were in great demand in the English settlements of Westchester and Long Island. By the time New Netherland passed under English control in 1664, its towns and bouweries were well supplied with slave labor.

Slavery became increasingly important after the English occupation. The rapid growth of the economy created an increased demand for all categories of labor. The demand existed in towns as well as in rural areas. Since free workers were not available in sufficient numbers, users of labor mainly depended upon Negro slaves. By 1677, in the opinion of Governor Bellomont, slaves had become the principal source of labor in New York.

The profits obtainable in the slave trade attracted a wide range of interests and individuals. For many years prior to the Revolution, New York's leading citizens participated in the commerce. Most of the slaves transported to New York in the eighteenth century were brought from the West Indies. The complexity of New York's economy discouraged the importation of untrained slaves directly from Africa. Slave owners placed a premium on the skills and training "seasoned" Negroes from the West Indies possessed.

Slave labor in New York had some of the characteristics of free labor. Slaves were not massed on large plantations or concentrated in the hands of a few owners. They were scattered in twos and threes among numerous users of labor in nearly every craft and trade. Many urban slaves were highly skilled and were employed in trades usually identified with free labor. Moreover, they had a mobility not common to slavery. Large numbers were hired out by owners who did not need their immediate services. Hired slaves were employed by numerous users of labor who were not themselves slaveholders. Many slaves spent the greater part of their time working for persons other than their owners. They moved from one employer to another as free workers might drift from job to job. When their labor was needed, they were hired; when no longer needed, they were discharged.

The economics of slaveholding determined the character of slavery in New York. The typical slaveholder was a small artisan who purchased one or two slaves to assist him in his craft. The artisan-slaveholder regarded slaves as a substitution for free labor which was either too expensive or unobtainable. Although slaves represented capital, this fact was of secondary importance in New York. The slave was primarily a worker needed to perform labor for which free workers were not available. Slavery in New York was never regarded as a basis for social organization. Implicit in the practice of New York slavery was the idea that Negroes should be slaves so long as their labor was needed and no longer.

An expanding supply of free labor in the late eighteenth century made the extinction of slavery inevitable. Slavery required a large capital investment with high maintenance costs. Slaves were property as well as workers and had to be supported whether occupied or idle. The costs of slavery were fixed and could not be reduced during periods when slaves were unemployed. Free workers, however, when available in sufficient numbers, could be hired at subsistence wages and discharged to shift for themselves when not needed. As the supply of free labor grew, the relative costliness of slavery resulted in an increasing use of free workers.

The economic changes of the late eighteenth century created a favorable context for the antislavery movement. They complemented the ideology of the American Revolution that brought slavery under attack on humanitarian grounds. The statutory suppression of slavery began in 1799 with the passage of the Gradual Manumission Act. The Act of 1799 provided that slave children born after 1799 were to be free, males at the age of twenty-eight, females at the age of twenty-five. Finally, in 1817, the legislature abolished slavery completely after 1827, the year in which slave children would be free under the Act of 1799. The law contained an exception permitting nonresidents to bring slaves into New York for periods up to nine months. The dispensation remained in effect until 1841 when the emergence of slavery as a national issue made it unpalatable. With the repeal of the transient privilege in 1841, slavery passed completely from the life of New York.
Microfilm $4.00; Xerox $13.60. 311 pages.

THE MARITIME POWERS AND SWEDEN, 1698-1702

(L. C. Card No. Mic 59-4028)

Edward William Natharius, Ph.D.
Indiana University, 1959

The Baltic region was vital to both England and Holland. Baltic exports formed an essential part of Dutch commerce, and England obtained the bulk of her naval stores from there. During the reign of William III a common approach to Baltic diplomacy was pursued by the King and the Pensionary of Holland, Antlionie Heinsius. Late in 1697 they were working to improve relations with Denmark and

Sweden, since the efforts of the Maritime Powers to block neutral trade with France during the recent war had alienated these Baltic powers.

Attempts to conclude an alliance with Denmark foundered on the exorbitant Danish demands, and Sweden appeared to be pro-French. The animosity between Denmark and Sweden presented an additional complication. The Swedes were allied with Holstein-Gottorp, the hereditary foe of Denmark, and Charles XII in 1698 reaffirmed these ties. The same year Sweden concluded a "Renovation Treaty" with the Dutch. A general alliance between Sweden, England, and Holland was signed in May, 1698.

Denmark, Augustus of Saxony-Poland, and Peter the Great, meanwhile, had formed an anti-Swedish coalition. The year 1699 saw a crisis in Danish-Holstein relations, and Sweden turned to closer relations with the Sea Powers. In January, 1700, a Triple Alliance and an Anglo-Swedish Treaty was concluded. Two months later the Saxons invaded Livonia and Denmark attacked Holstein-Gottorp. Sweden called upon England and Holland for aid. An Anglo-Dutch Squadron was dispatched to the Baltic. The Fleet of Sweden joined it, and the Danish Navy was immobilized. Charles XII then invaded Zealand, and Denmark was forced to agree to peace at Travendal.

Tsar Peter now declared war, and Sweden again requested assistance. The vulnerability of Holland to Russian commercial reprisals and the Spanish Succession crisis prevented the Sea Powers from granting this. England and Holland now required auxiliary troops, and Sweden's foe, Denmark, agreed to furnish them. Negotiations for Swedish soldiers resulted only in the Convention of 1701 which granted Sweden financial aid and a loan. Charles XII carried his war against Augustus into Poland, and the likelihood the Maritime Powers would secure Swedish soldiers diminished greatly. Augustus, on his part, opened negotiations with Austria and the Sea Powers offering them troops.

Dutch and English merchants, meanwhile, were supplying Russia with munitions. Swedish efforts to control this contraband trade antagonized mercantile circles in England and Holland. Charles' blockade of Baltic ports seriously hampered the flow of naval stores when war with France was about to break out. The possibility that Charles would invade Saxony made the Sea Powers fear that the Germans would be recalled from their service.

By 1702 the enemies of Sweden, active and potential, were providing England and Holland with troops for the War of the Spanish Succession. Nothing was to be expected from Charles XII. While it was essential to the Maritime Powers that Germany remain quiet, Charles could defeat Augustus only if Saxony were invaded. The commercial interests of Sweden and the Sea Powers were also incompatible. Active cooperation between them was no longer feasible. Microfilm $4.85; Xerox $16.20. 280 pages.

THE GENOESE IN SEVILLE AND THE OPENING OF THE NEW WORLD

(L. C. Card No. Mic 59-4083)

Ruth Pike, Ph.D.
Columbia University, 1959

The sixteenth century brought profound economic changes to Europe. During those turbulent years a civilization based upon an inland sea and a limited decentralized economy was transformed into a society characterized by an expansive and dynamic spirit of capitalist endeavor. The new world of the sixteenth century took its character from the outburst of economic energy into which it had been born. For centuries Europeans had been pressing against the narrow framework of medieval society. The heralds of this movement were the Italian city-states, particularly Venice, Florence and Genoa, which since a very early period had dedicated all their energies to the creation of commercial societies. Of the three, only Genoa was able to survive the impact of the economic revolution of the sixteenth century and to assume an important commercial and financial role in the early modern era.

It was Genoa's association with Spain -- the most important nation of the new period -- which enabled her to continue, in the early modern era, her predominant position in commerce and to extend her activities in international finance to a point undreamed of in the Middle Ages. As early as the twelfth century, the Genoese had come into maritime relations with both Christian and Muslim Spain and by the following century they had established commercial colonies in the important Spanish cities of the Mediterranean littoral. The strategic location of the Andalusian river port of Seville along the route to England and Flanders drew large numbers of Ligurians to that city in the fourteenth century. The opening of Africa by the Portuguese in the following period provided a further stimulus to Genoese concentration in the river port and other Andalusian coast cities.

During the Middle Ages the members of the Genoese colony of Seville began to invest their surplus capital in moneylending. Originally the city government and the local nobility had been the chief beneficiaries of these loans but by the early fifteenth century the power of Genoese capital had attracted the Spanish sovereigns. By the time their compatriot Columbus discovered America, they were recognized as a most important source of royal funds. The precedent was set for their role as the principal bankers of the Spanish crown in the second half of the sixteenth, and early part of the seventeenth century.

The discovery of America and the opening of trading relations with the new continent was the turning point in the history of the Genoese in Spain. The present study attempts to expose and analyze the participation of the members of the Seville Genoese colony in the American trade during the sixteenth century and to show how they used the capital drawn from this trade to engage in financial operations with Charles V and Philip II. Genoese intervention in other parts of Spanish economy is also described. Here particular emphasis is given to their activities within the wool and silk industries. Material relating to the economic conditions of the period, the Price Revolution, the monetary needs of the crown, the policies of the Cortes and the state of Spanish industry has been included, since the ultimate monopolization of Spanish

economic life by the Genoese is incomprehensible without a knowledge of these factors.

Aside from purely economic conditions, some mention is made of Genoese infiltration into Sevillian life. Wherever possible, glimpses of their family life and their social relations with the rest of the population of the river port are given.

The research for this dissertation has been done principally at the Archivo de Protocolos in Seville. Here notarial deeds involving Genoese residents of the city in the sixteenth century were examined and many of them photocopied for further study. This is the first time that these protocols have been used for a study of this type.

Microfilm $3.60; Xerox $12.20. 278 pages.

A MILITANT NEW WORLD, 1607-1640: AMERICA'S FIRST GENERATION, ITS MARTIAL SPIRIT, ITS TRADITION OF ARMS, ITS MILITIA ORGANIZATION, ITS WARS

(L. C. Card No. Mic 59-4245)

Darrett Bruce Rutman, Ph.D.
University of Virginia, 1959

Chairman: Professor Thomas Perkins Abernethy

For over two hundred years, from the first English settlement of America to the disasters of the War of 1812, the colonies and the United States of America relied for their defense on militia -- an armed citizenry capable of coalescing into military units to act against a foreign or internal foe. Even today, more than a hundred years after the use of the discredited formal militia organization was abandoned, the idea that the protection of the American states rests on the citizen himself is a part of the American psychology and the foundation of America's real strength. It is cemented into the national fabric by the existence of the National Guard, the military reserve and conscription.

Where in history rests the foundation of this institution?

Assuredly in America the principle, though not the form, of militia began when the first English colonists stepped ashore on a Southern river bank or a New England rock. It was an integral part of the colonial inheritance from England. There, the militia principle had existed for centuries, underlying the military structure of the Saxons, the feudal kinds, Elizabeth I and the early Stuarts. The principle had, however, become encrusted with the barnacles of cynicism, apathy and misuse by 1607. Playwrights (Shakespears among them) and pamphleteers mocked the militia as a thing "of disport and no importance." Viewing the complacency and lack of preparedness of the time, one English soldier spat out: "This kingdom has been too long at peace . . ." In a word, the English militia system of 1607 was the mere remnant of an institution.

Yet this remnant was to be given new life upon being transplanted to the New World. Faced with the strangeness and danger of the American environment, the early colonists banded together for their mutual protection as they had never done in England. And though the militia tradition was the basis of their defensive measures, it was strongly augmented by a new professionalism rising on the continent of Europe -- a professionalism of which England herself was only gradually becoming aware. In each of the early colonies, veteran soldiers who had fought in the Low Countries and elsewhere appeared as military leaders, guiding the citizen-soldiers in their organization, training and method, leading colonial "armies" in the first Indian Wars. The influence of these veteran soldiers (persisting long after their personal leadership ended), the inherent necessity of preparedness in the New World and the incentive to protect a peculiar religion in New England and hard-won homes and farms in all the colonies, transformed the inherited militia. Inside of a single generation it became a well established, well functioning institution. In both organization and effectiveness, the English model was quickly surpassed; the existence of militia as the foundation-stone of colonial defense was insured at the very time that England herself was moving toward reliance on a standing army. And the colonial citizen-soldier assumed a militancy and aggressiveness almost unknown in the average Englishman. The story of this transformation -- one facet of the early emergence of an American character -- is the subject of the present study.

In time, the work spans the period from shipboard organization to 1640, a period largely neglected by chroniclers of colonial institutions who have concentrated on the established structure to the neglect of origins. Geographically, it includes all the colonies established prior to 1640, with special emphasis on Virginia and Massachusetts Bay, the two colonies most representative of the peculiar developments in their respective sections. In scope, the work accents military developments but embraces a broad view of colonial foundations -- a result of the impossibility of separating military activity and militant spirit from the everyday social, religious and economic life of the citizen, or from the politics of the earliest colonial governments.

Microfilm $10.50; Xerox $37.80. 838 pages.

RABBI ISAAC ELCHANAN SPEKTOR, HIS LIFE AND WORKS

(L. C. Card No. Mic 59-3007)

Rabbi Ephraim Shimoff, D.H.L.
Yeshiva University Graduate School, 1959

Rabbi Isaac Elchanan Spektor, an outstanding Talmudic scholar of the past century, was born in 1817 and died in 1896. The city of Kovno, which he served as rabbi for over three decades, became famous because of his spiritual leadership. He was recognized as a halakhic authority whose opinion was also sought by rabbis of foreign countries. He was particularly concerned with the problem of the agunah and used his vast Talmudic erudition to come to her aid. In practically all cases, he rendered lenient decisions. He firmly believed in the Talmudic dictum: "the power of the heter is superior."

Rabbi Isaac Elchanan was also a gifted communal leader, and although he did not speak nor understand Russian, the Russian government recognized him as the spokesman of the religious Jewry. He worked energetically to ameliorate the lot of Russian Jewry and it was through him that the Western World learned of the plight of the Russian Jew.

When the "Hobbei Zion" was organized, Rabbi Isaac

Elchanan helped to spread its ideology and supported it strongly. He had a profound love for the new Yishub. When the problem of shemitah, in 1889, endangered its existence, Rabbi Isaac Elchanan devised a heter which is still used to this very day. Microfilm $2.55; Xerox $9.00. 196 pages.

WESTERN EUROPEAN TRAVELLERS TO MAINLAND GREECE, 1700-1800

(L. C. Card No. Mic 59-3226)

Betty Mack Silvestro, Ph.D.
University of Wisconsin, 1959

Supervisor: Professor Michael B. Petrovich

The published unofficial accounts of Western European travellers to mainland Greece (1700-1800) furnish a body of information for the study of Greece which has not been explored adequately. Because of the dearth of available documentary sources, the historian interested in this period of Greek history must lean heavily on the travel account.

Relatively few men and women visited the Levant in the eighteenth century; most of those who did go visited the Greek islands and Constantinople. Less than one hundred determined travellers braved the additional rigors of a tour of mainland Greece and published accounts of their experiences. Antiquities, trade, science, and adventure were the four major attractions that lured travellers to the mainland.

Travellers recorded their impressions of the nature of Greek and Turkish institutions, the state of agriculture, commerce, education, and the Church. They commented on the practices of pashas, primates, and other officials, differences in Greek local autonomy, and the chance for Greek liberty. There is hardly any phase of the social, cultural, economic, and political life of Greeks that travellers did not observe.

In analyzing these travel accounts, the historian must subject them to the same kind of criticism that he would apply to any historical source. The trustworthiness of all travel accounts differs greatly because their authors were not equally competent and honest. The accuracy of their observations reflects this inequality and varies with each traveller's personal qualities and the conditions under which he wrote.

The special intellectual environment of eighteenth-century travellers to Greece had a profound affect on the nature of their accounts. Their works reflect two important influences: (1) the philosophy of Rationalism with its emphasis on accuracy and detail, and (2) the effects of a classical education. The majority of Western European travellers who visited mainland Greece were primarily interested in the antiquities -- not the Greek people. The result is a literature of travel about Greece in which the modern Greeks occupy the smallest part.

In spite of their deficiences, these chroniclers of a little-known period and region can be read with profit. From their accounts emerges a picture of Greece in which the condition of Greeks on the mainland appeared in marked contrast to that of the island Greeks, Constantinople, and other parts of the Levant. The travel literature indicates distinct differences in the relationships between Greeks and Greeks, and between Greeks and Turks in different parts of the mainland. There were large parts of Greece virtually unaffected by the progress in cultural and political nationalism that was taking place elsewhere. By the close of the century, travellers who knew the mainland best did not foresee an immediate Greek revolution and did not believe that the Greeks were ready for freedom.

Unfortunately for the historian, the validity of the travellers' observations is difficult to determine because of the dearth of contemporary documents with which they might be compared. But what travellers wrote about Greece is important, for their accounts became the basis of what Western Europeans believed to be true. Thus the travel literature of the eighteenth century helped to stimulate a popular interest in Greece which, in the next century, was destined to play a significant role in the literature, art, and diplomacy of Western Europe.

Microfilm $4.95; Xerox $16.40. 385 pages.

THE COLLAPSE OF FRANCE IN WORLD WAR II AND THE ARMISTICE CONVENTIONS OF JUNE 1940

(L. C. Card No. Mic 59-3958)

Brenton Hoyt Smith, Ph.D.
University of Michigan, 1959

The study presented here concerns the record of France in the Second World War. Even before it began, high-ranking French soldiers and politicians were admitting in private council that the nation simply did not have the military force necessary for a large-scale attack upon the enemy in the near future. The crisis of early September, 1939, provoked by the German thrust into Poland, found the French, if not the British, still desperately desirous of peace even perhaps at the cost of further concessions to Hitler. Though British determination and pressure soon contributed greatly in getting the Paris cabinet to declare war, British determination and pressure were not enough to get that cabinet to wage it aggressively. Poland was left to her doom. The French felt themselves much too weak for any momentous effort even when their foe was thoroughly engaged in the east. Furthermore, their strategy was an unchangeably defensive one supposedly justified by the lessons of the First World War.

In the campaign on the western front of the following May, it was almost immediately apparent that the Wehrmacht command excelled not merely in offensive striking power, tanks and airplanes, but also in boldness and imagination in the disposition of its forces. By May 25 they had scored a decisive victory by reaching the channel coast at Abbeville and surrounding the best and strongest allied divisions, which had in the meanwhile marched into Belgium. No escape proved possible. With the battle for France virtually decided by May 25 French leadership should have been making swift political and military decisions of the first importance. Instead, what followed was three weeks of futile sparring between a tradition-bound military command which was sure that the war was totally lost and a politically weak premier who wished to carry on the battle against the enemy with France's navy and colonies. Though neither side had the courage or strength to force the issue immediately, it was clearly General

Weygand, Marshal Pétain, and the army command whose position was improved by this situation, not that of Reynaud and the "die-hards" whose program required a good measure of deliberate preparation. In the final crisis of mid June with all of its hysteria and consternation, Reynaud found that support for his ideas was failing rapidly even in the cabinet and that he must yield his office to Pétain and the peace-makers. Meanwhile the strategy of Great Britain and her slight contribution to the war effort irritated all official circles in France and strengthened most especially the hand of those persons who wished to desert the common cause. The land forces sent by Britain to the western front in this war were far fewer than in the previous war, and at critical times they were not disposed as the French command desired. The eventual evacuation at Dunkerque, though a brilliant operation, left the French bitter in the feeling that the ally had thought more of his own safety than of the needs of the partnership. From this point onward France alone would be carrying on the combat. Most especially, though, there was anger at Britain's absolute refusal to engage the whole of her airforce at any point in the battle for France.

Thus the most important conclusions drawn from this study are that the armistice of June 25, 1940 was an almost inevitable ending for a rather unspirited and dubiously organized French campaign and for a developing bitterness between the two allies. The armistice, though a violation of France's given word, came as no great surprise to Britain. It was thoroughly in line with past precedents of warring powers in about the same circumstances and was to be expected by international practice. The armistice as a political calculation was a sound one in view of the hopeless prospects of the time. Even so, the French did not perhaps hold out, primarily in regard to the naval clause, for the best possible terms to which they were entitled by the existing military situation and which Hitler might eventually have granted.

Microfilm $7.30; Xerox $25.00. 573 pages.

THE PICTORIAL REPORTING AND PROPAGANDA OF THE CIVIL WAR

(L. C. Card No. Mic 59-3294)

William Fletcher Thompson Junior, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor William Best Hesseltine

The Pictorial Reporting and Propaganda of the Civil War considers two hitherto unexplored aspects of the American Civil War. It is first, a study of the images of the Civil War as created by the wartime illustrators, photographers, cartoonists, and commercial artists, some of whom served as pictorial reports, while others used pictures as editorials to shape public opinion. Second, it shows for perhaps the first time how the historian can use journalistic pictures as primary historical documents.

The martial tradition with which most Americans started the Civil War consisted of a number of romantic images. These maintained that Americans fought only in defence of great moral and political principles, and consequently that the free-born militiaman and the volunteer were superior to the professional soldier, that moral fervor was more important than military experience, and that soldiers were crusaders who instinctively performed magnificent feats of heroism. These images were established by artists, most of whom had never accompanied an army into the field. For the first time in 1861 photographers and sketch artists who provided illustrations for Harper's Weekly, Frank Leslie's Illustrated Newspaper and the New York Illustrated News lived constantly with the armies. Like the troops with whom they associated, they soon realized that the stereotyped images were erroneous and meaningless. Gradually they abandoned them, and on the basis of their own experience and observations they created more realistic images that emphasized the complex nature of warfare, the routine of camp life and picket duty, the army on the march, and the chaos and slaughter of combat.

At the same time, editorial artists on the home front used illustrations and cartoons to interpret the issues and meaning of the war. They helped mobilize public opinion to support the war with men and money; they tried to create a climate of conformity around such issues as loyalty and patriotism; they lent support to the campaigns for emancipation and the utilization of Negro troops; and in 1864 they crusaded for or against the re-election of Abraham Lincoln. The main purpose of the photographers and artists with the armies was to enlighten the public; the editorial artists were primarily concerned with indoctrination and propaganda.

By the time of the surrender at Appomattox, Americans in the North had witnessed four years of warfare through the effort of artists, photographers, and cartoonists. Many of their intense feelings about the war were a direct result of having shared in this way the experiences of their fathers, sons, and husbands.

Microfilm $4.75; Xerox $16.00. 372 pages.

THE CROSS AND THE FASCES: CHRISTIAN DEMOCRACY AND FASCISM IN ITALY

(L. C. Card No. Mic 59-4098)

Richard A. Webster, Ph.D.
Columbia University, 1959

The Italian Catholic political movement began in the 1860's and 1870's as a protest against the Liberal State, which had despoiled the lands of the Church, usurped the Pope's temporal power, and secularized the universities. The Catholic Congresses of 1874-1904 were in "intransigent" opposition to the Italian government. However, the Catholic movement soon ceased to be a simple expression of protest. On the one side much of the Catholic laity and clergy of North Italy aimed at conciliation of Church and State and the formation of a Catholic conservative party. At the other end of the spectrum, a number of "Christian Democratic" groups, inspired by the encyclical Rerum Novarum (1891), tried to combine the longed-for Catholic reconquest of society with a program of democratic reforms. They accepted for the moment the "intransigent" ban on parliamentary politics, but proposed eventually to launch a great Catholic party of the Left, in competition with the rising forces of Italian Socialism.

The resulting dissension within Catholic ranks was tolerated by Leo XIII, but his successor, Pius X, imposed silence and conformity on Italian Catholic movements. Catholics were allowed to vote in critical areas, where Socialism threatened, but there was to be no independent Catholic party. Many Christian Democrats submitted: a small group in the Romagna carried on Christian Democratic propaganda, while the Sicilian priest Sturzo elaborated the conception of a party of Christian inspiration autonomous in its relation to the Holy See.

The events of 1911-1918 -- the wars, the enactment of universal suffrage, the revolutionary turn in Italian Socialism and the accession of Benedict XV -- all led to a radical change in the politics of Italian Catholics. Benedict allowed the formation of a single party embracing all militant Catholics. The Popular Party, led by Sturzo, was avowedly autonomous and non-confessional, with a Christian Democratic left wing and a "Clerical" right.

During the prolonged crises of 1919-25 the Popular Party, which held twenty per cent of the seats in Parliament, blocked the advance of Socialism in much of the countryside and participated in successive coalition governments. But the Fascists, who pushed forward as the Socialist tide ebbed, undermined the Popular Party by promising to defend religion and property. Pius XI (1922-1939) withdrew Vatican support from the Popular Party, emphasizing instead the role of Catholic Action organizations under direct hierarchical control. The Popular Party was left to expire under Fascist pressure, while Pius XI and Mussolini began negotiating a Church-State settlement. During the final crisis of Italian democracy the "Clerical" wing of the Popular Party went over to Fascism, but the rump of the Party continued the hopeless struggle until 1926.

The 1929 Lateran Pacts changed the foundations of Italian Catholic life. Catholic Action and the Catholic University of Milan were permitted by the Fascist Regime as an independent enclave within Italy, though under strict ecclesiastical control. Autonomous action by Catholic laymen was difficult, for Catholic organizations owed their existence in Italy to papal and episcopal protection.

Between 1929 and 1943, in spite of collaboration between Church and Regime in education, family and other areas, a new Christian Democratic tendency arose within Catholic organizations. Anti-Fascists like De Gasperi, an old Popular Party chief employed in the Vatican, La Pira of Florence and Malvestiti of Milan kept alive the aspirations of Christian Democracy. They found disciples among the leaders of the National Federation of Catholic University students, like Gonella and Moro. In spite of Fascist police repression these groups laid the foundation for the post-war Christian Democratic Party.

In contrast, many old "Clericals," as well as Father Gemelli and the social scientists of the Catholic University of Milan committed themselves to Fascism up to 1941, when the war began to go badly. By then the bulk of Italian Catholics had already turned against the Regime, which had brought German racism into Italy as part of the unpopular Axis policy.

During the Resistance (1943-1945) the Christian Democratic Party, reconstituted throughout Italy, played a cautious but important role in the North Italian Committees of National Liberation. Under De Gasperi's moderate leadership the new Catholic party, though far more closely tied to the Vatican than the old Popular Party, became the mass party of Italian constitutional democracy. In the post-war Republic the Catholics have provided the only effective mass support for successive moderate governments.

Microfilm $4.20; Xerox $14.20. 327 pages.

THE METHODIST EPISCOPAL CHURCH AND GRANT'S PEACE POLICY: A STUDY OF THE METHODIST AGENCIES, 1870-1882

(L. C. Card No. Mic 59-3770)

Robert Lee Whitner, Ph.D.
University of Minnesota, 1959

Adviser: W. Donald Beatty

From 1870 to 1882, as part of Grant's Indian peace policy, the seventy odd Indian agencies were divided among thirteen religious denominations for the purpose of nominating the Indian agents. It was hoped that better men would be obtained for agencies and that the work of Christianizing and civilizing the Indians would be improved and extended. It was expected that the missionary societies of the participating church would undertake educational and missionary work on the reservations for which they nominated agents if they were not already doing so.

The churches and their missionary societies, however, were unable to improve or influence Indian administration in any significant way. The reservation system had already been established. The business of conquering a continent from a people few and weak was substantially complete, for the decade of the peace policy saw the last of the Indian wars. The churches had little influence over Congressional appropriations for the Indian service and over the intellectual climate of the frontier which did not recognize that the Indians had any rights. If the government could not stop the pernicious liquor traffic nor prevent white encroachments on Indian lands, the churches could hardly be expected to do so. Though this system of nominating Indian agents was intended to remove the Indian service from politics, politicians who passed appropriations bills and ratified the appointments of agents did not always agree that this was an appropriate goal.

The Methodist Episcopal Church nominated agents for fifteen agencies, the largest number of any of the thirteen participating churches. The Missionary Society, through which the Church participated in the plan, was never able to perfect a system by which it could be certain that its nominees were capable, qualified, and honest men. While perhaps the best agent in the service, James H. Wilbur of Yakima, was a Methodist nominee, so also was George I. Betts of Mackinac, who was one of the worst.

The Missionary Society failed to increase materially either the educational or religious work performed on its reservations. The decentralized conference of the Church was partly responsible for this. More important was the admitted lack of interest in Indian work compared to what it had been earlier and compared to a much greater interest in foreign missions. Methodist participation in the peace policy came at a time when enthusiasm for Indian work was low, as was evidenced most dramatically by the Society's meager expenditures on Indian missions during the years of the peace policy. Furthermore, the Church,

through its organ, The Christian Advocate, accepted the principles of Social Darwinism, by which the Indian was considered an inferior, incapable of being civilized, and, therefore, deserving of conquest by his white superiors.

The most striking feature of the Methodist participation in the peace policy was the Church's use of it as an instrument of anti-Catholicism. Attempts by the Catholic Church to establish schools, missions, and churches met strong opposition from Methodist agents and officials of the Missionary Society. Indeed, it appears that the Methodist worked harder to keep Catholic priests and teachers off their reservations than they did to improve their own religious and educational facilities.

The Missionary Society of the Methodist Episcopal Church did little to improve the service, the quality of the agents, or the condition of the Indians. It did more to perpetuate sectarianism and intolerance and bigotry. It must be concluded that the record of its participation in the peace policy was largely a failure.

Microfilm $3.85; Xerox $13.00. 298 pages.

THE FRENCH ZONE OF OCCUPATION IN GERMANY, 1945-49

(L. C. Card No. Mic 59-3728)

Frank Roy Willis, Ph.D.
Stanford University, 1959

This dissertation studies (a) the reasons why France was granted a zone of occupation in Germany and the manner in which the boundaries of the zone were decided, (b) the effect of France's presence as an occupying power on overall French policy toward Germany, 1945-1949, and (c) the policies of the French military government in the zone of occupation.

(a) In 1943, Churchill, Roosevelt and Stalin had planned for a three-fold occupation of Germany, and by September, 1944, the zones of occupation had been assigned. However, the revival of French power, through the efforts of the Free French under de Gaulle and of the Resistance forces in occupied France, coupled with the desire of Britain for a strong France as an ally in post-war Europe, led Churchill to ask, at the Yalta conference, for the grant of a zone to France.

The boundaries of this zone were not agreed upon until June, 1945; and during the invasion of Germany, March-May, 1945, the French First Army seized as large an area as possible, in order to influence the boundary negotiations in France's favor. The zone France received was cut from the British and American zones, consisted of portions of eight Länder, and was largely agricultural, with the exception of the Saarland. The zone was able, however, to export products vitally needed by France, such as coal, chemicals, wood and machinery.

(b) The French used the bargaining power which occupation of a zone gave them to influence allied policy toward Germany. Foreign Minister Bidault, with the support of all French political parties, pressed the "French thesis:" internationalization of the Ruhr, economic fusion of the Saar with France, and detachment of the Rhineland from Germany. He refused to sanction any measures of centralization in Germany until these demands had been met. As a result of French vetoes in the Control Council, by 1946 the four zones had become virtually autonomous.

In 1948, with the intensification of the cold war and the grant of Marshall aid to France, the French government acquiesced in the decision of the London conference, (February-June, 1948), by which the French zone was to be merged with the British and American zones in the formation of the West German Republic (September, 1949).

(c) After a brief period of spectacular extravagance under General de Lattre, the permanent military government was established in Baden-Baden in August, 1945. The zone was administered by the army and the civilian "military government." Both were criticized, with at least some justification, for the presence of Vichy collaborators, for inefficiency and for extravagance.

The French exploited Germany economically. Reparations were taken by dismantling of factories, by confiscation of a percentage of current production, and by sale of large quantities of German products to France at a 20 per cent discount. The Germans paid the cost of the occupation army and military government. Moreover, the military government encouraged industries useful to France, such as coal and timber, and maintained a surplus of exports over imports until December, 1947, thereby avoiding any charge on the French treasury until the zone was offered Marshall aid.

Denazification was not carried out thoroughly, except among teachers and lawyers. A major aim of the military government was to remold the Germans in the zone by a thorough re-education and by a gradual revival of democratic institutions. Microfilm $3.85; Xerox $13.00. 300 pages.

THE GENESIS OF TVA

(L. C. Card No. Mic 59-3236)

Sarah Elizabeth Bosely Winger, Ph.D.
University of Wisconsin, 1959

Supervisor: Howard K. Beale

The period of this thesis extends from the pre-Revolutionary War period to the passage of the first amendments to the TVA Act in 1935.

The early part of the work covers the struggle of the pioneers to gain possession of and keep control over the area west of the Appalachian highlands. The major part of the thesis deals with the genesis of the conservation movement, including the various progressive groups that assisted the conservationists to pass necessary legislation to implement their program. An impressive body of new scientific data amassed before the turn of the century assisted the progressives in their drive for greater, and yet more beneficial use of the nation's resources. Early in the present century, it was firmly established in progressive circles that the nation's rivers constituted an important resource for the American people: first, as a source of water for irrigation; second, as a means to break the railroad monopoly; and third, as a source of cheap hydroelectric power, if development of this power were not allowed to fall under control of the rapidly-growing power "trust." The conservationists and the progressives also realized that all phases of human life in a given river basin could be materially improved, if the resources were integrated into a unified system by government, preferably, the federal government.

All of the aspects of river development and use were

demonstrated in the Tennessee River basin. Demand for improvements to aid navigation began in 1828 and continued to the passage of the TVA Act in 1933. In 1899 private power companies began their drive to secure control of Muscle Shoals. Plans for private development of Muscle Shoals and other areas of the Tennessee region were interrupted by passage of the Defense Act of 1916, which prohibited the federal government from entering into any kind of partnership with private industry to operate the government property, intended for the production of nitrates for defense and agricultural purposes. Despite the restriction against private operation of the Muscle Shoals property, there was a long and bitter fight after the war to prevent this property from being either leased or sold to private companies for a nominal sum. Government control of Muscle Shoals was retained only as the result of the stubborn fight carried on by Senator Norris and a small group of dedicated progressives. The establishment in 1920 of the Federal Water-Power Commission after a twenty-year struggle to define the national government's policy over the nation's rivers prevented other valuable sites on the Tennessee from falling into the hands of the power companies to be developed in a piece-meal fashion.

During the 1920's Senator Norris and his group did not plan beyond the use of Muscle Shoals for improvements in navigation, manufacture of nitrates, production of electric power at Wilson Dam, and flood-control by means of a second dam, Cove Creek Dam. With the advent of Franklin D. Roosevelt and the New Deal, a full-scale valley-development experiment was launched, using Muscle Shoals as the point of departure.

It is the purpose of this thesis to demonstrate the various forces producing the ideas that culminated in the creation of the TVA concept. TVA did not come full-blown from the mind of any one man or group of men, but was the product of a long and painful struggle by many men over a long span of time. Microfilm $10.35; Xerox $37.20. 825 pages.

JOURNALISM

SIX NEW YORK NEWSPAPERS AND THEIR RESPONSE TO TECHNOLOGY IN THE NINETEENTH CENTURY

(L. C. Card No. Mic 59-3762)

Calder M. Pickett, Ph.D.
University of Minnesota, 1959

Adviser: Edwin Emery

This study, based on newspaper files and histories, demonstrates how six New York newspapers responded to the coming of technology and industrialism. Four key printing developments occasioned particular responses: the steam printing press, telegraph, Linotype, and photo-engraving. Newspapers commented on and used inventions, adapted themselves to changing concepts of journalism and newspaper-making, and responded to socio-economic and political conditions arising from technology.

The Evening Post commented enthusiastically on inventions but made little use of them. Its growth was slow; its development, after 1850, was due chiefly to belated modernization. It remained a political, rather than a mass, journal. It was affected little by sensationalism, which arose out of the steam press, or the news function, which arose out of the telegraph. It editorially condemned sensational techniques. It combated evil effects of industrialism, favored the individual over government and plutocracy, retained agrarian and romantic values.

The Sun, first of the penny papers, was a creation of technology. It expressed interest in science and mechanization. It installed new machinery; its growth was rapid, though the paper declined in late century. It altered the news concept, stressed sensation and human interest, made mass appeals. It showed little interest in conditions arising out of technology and became a defender of the status quo in its later period.

The Herald accepted inventions implicitly; it made few comments on them. It was alert in its use of inventions; it grew phenomenally, became the leader in New York journalism, declined only when it failed to keep pace with more aggressive journalism. It was highly sensational and news-conscious; it created news, and paid little attention to its potential editorial influence. Its response to socio-economic conditions was slight, though it gave lip service to the working class.

The Tribune spoke for the industrial age, though paradoxically it favored agrarianism. It readily accepted inventions; it pioneered in the Linotype. Its growth was steady. It opposed sensationalism but combined news and editorial influence to become nationally recognized. It made slight accommodation to mass techniques. Under Horace Greeley it was a reform journal, and campaigned for labor, homestead legislation, socialism. It later became an apologist for the plutocracy.

The Times wholeheartedly accepted technology and served as a spokesman for industrial progress. It enjoyed material success except for a brief period in which old-fashioned practices brought a decline. It was non-sensational; it responsibly covered the news. Its success was due to its middle position between sensationalism and political radicalism. Its acceptance of industrialism was implicit; the paper envisaged few evils as products of industrialism.

The World was the culmination of the mass press, under Joseph Pulitzer it was a balanced newspaper that editorially praised technology and utilized inventions. It used both sensation and crusade formulas. It vigorously and imaginatively covered the news. With yellow journalism in the 1890s it became irresponsible, but it returned to a sane policy. It opposed plutocracy and corruption and fought for free trade and labor.

Conclusions: Technology affected each newspaper, and each found some accommodation to technology necessary for survival. But each responded distinctively to technology; there was no set pattern of response. Out of technology arose the mass press, and responsible reporting. Out of technology arose the balanced newspaper, the best product of technology, a newspaper that held a responsible attitude toward industrialism and the changing concepts of journalism.

Microfilm $5.50; Xerox $19.20. 429 pages.

LANGUAGE AND LITERATURE

LITERARY CRITICISM IN BRITISH PERIODICALS TO THE MID-EIGHTEENTH CENTURY.

(L. C. Card No. Mic 59-4218)

Edmund P. Dandridge, Jr., Ph.D.
University of Virginia, 1959

The sudden and rapid growth of the British periodical press during the early decades of the eighteenth century changed drastically the reading and writing habits of the average literate Englishman. The periodicals not only provided new and widely varied reading material, but also offered a ready outlet for the products of readers' minds and pens, thus stimulating the public to vigorous literary activity in a multitude of areas, one of which was literary criticism.

This study surveys the criticism in the periodicals in an effort to determine what interested the critics, what some of their major critical ideas were, and how they went about their task, which they conceived to be primarily the education of the public taste.

An account of the abrupt and rapid development of the periodical press is followed by an examination of the rapidly broadening interest in writing and criticising in the periodicals. The wide diversity of form and content of the critical materials is then considered, and is followed by the reflections of the critics on their craft, their ideas concerning the function of literature in general, and their conceptions of the various attributes necessary to the good author. Their interest in the analysis and definition of various abstract terms such as wit, taste, judgment, and humour is examined; and theories of the well-made poem, play, and novel are outlined. In connection with the drama, the growing trend away from the application of most of the neo-classical Rules is noted. The development of book reviews from lengthy summaries of books with almost no critical comment into actual critical reviews is followed by an account of the increasing interest in textual and historical criticism. Finally, an attempt is made to assess the significance of the periodical criticism in the contemporary literary scene and to indicate its relationships to the critical temper and doctrine of the age.

On the whole, the criticism in the periodicals reflected conventional neo-classical precepts about literature. In particular, the critics stressed the importance of the instructive element in literature and insisted in the adherence to poetic justice in the drama. At the same time, much that was new mingled with the old. For example, the demand for originality increased. In addition, liberality in criticism became more common, and critics dwelt more on beauties than on defects in literary works.

In all their interests, the periodical critics revealed that for them criticism was a practical craft rather than one to be approached philosophically. Their main task was to lay before the public, through general discussions of critical ideas and principles, or through the application of particular principles to particular works, sensible standards based on reason and common sense for the evaluation of literature. By mid-century, the periodical critics achieved a place of major significance in the contemporary scene. They certainly did a great deal to popularize criticism and thus influenced strongly the average Englishman's attitude toward literature and other forms of art, and even perhaps toward life itself.

Microfilm $4.20; Xerox $14.20. 326 pages.

THE SATIRIC MORAL FABLE: A STUDY OF AN AUGUSTAN GENRE WITH PARTICULAR REFERENCE TO FIELDING.

(L. C. Card No. Mic 59-3267)

Thomas Charles Kishler, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Ricardo Quintana

The purpose of this study is to develop an approach to the aesthetics of non-realist eighteenth-century works of satiric fiction, to demonstrate the affinity of these works in terms of their shared characteristics and of the artistic and ethical presuppositions which lie behind them, and to suggest that they constitute a broad, yet distinct, genre. In evaluating Augustan satiric fiction, historians of the novel have generally overlooked the fact that this type of narration developed within an established aesthetic tradition, having its own implicit norms, and that though it developed simultaneously with the early novel it is different from this more realistic form of fiction in subject, technique, effect, emphasis, attitude towards plot and characterization, and general perspective. Therefore, the common practice of evaluating this type of fiction, termed in this study the satiric moral fable, on the same basis as the novel results in an inadequate appraisal, which disregards or minimizes the very characteristics which constitute its significance as a representative Augustan literary form.

Beast fables, allegories, dream-visions, dramatic impersonations, imaginary journeys or voyages, and, in general, works exploiting, through parody and burlesque, the comic possibilities of various literary types, which are themselves objects of satire, compose the main body of major and minor satiric moral fables in the Augustan period. These types reveal little concern for spatial-temporal-psychological individuation of character, for realistic narrative techniques, or for the immediacy of individualized experience. The satiric moral fable deals almost exclusively with instructive examples of ways of thinking and acting which are to be avoided and ridiculed. The intellectual and social aberrations of the outsider—the pedant, the enthusiast, the affected—are intentionally magnified beyond normal credibility in order that they may be more effectively and comically exposed.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Because an aesthetic of satiric fiction was never fully articulated in the period, it is appropriate that the satiric moral fable be approached in terms of Augustan literary and ethical presuppositions about the nature and function of satiric art in general. The comedy of form—that is, the localization of the satire in the structure of the work through the means of parody and burlesque—is, in most respects, the same as that in the mock-epic poem, and both illustrate the double vision and indirection characteristic of major Augustan satire. The most fully developed satiric fable results when the comedy of anti-types is merged with the technique of dramatic impersonation, whereby the first person narrator, himself often an object of satire, provides the ironic and shifting perspective from which the characters and actions are to be viewed and by which they are related to the carefully controlled intellectual comedy. This highly contrived use of fiction strongly militates against the realistic portrayal of character qua individual and plot qua credible action. Touches of realism, such as those in Gulliver's Travels, are part of the larger comedy, never ends in themselves.

Fielding's initial experimentations in satiric fiction in The Champion essays and other works show his preference for burlesque and parody and for the comedy of anti-types and dramatic impersonation as the technical solutions to the problems of narration. These experimentations culminated in Jonathan Wild, which is a composite of the characteristics of Augustan satiric fiction. The concept and use of plot and characterization in Jonathan Wild, Shamela, and other works underline the specialization of technique and limitation of scope responsible both for the artistic accomplishment of non-realist satiric fiction and for its weaknesses, particularly in characterization, with respect to the desiderata of the realistic novel.

Bringing the tradition of Augustan satiric fiction to a close, Johnson's Rasselas recapitulates many of the central features of that tradition, but indicates a decline in the comedy of anti-types, dramatic impersonation, and ironic tone. Microfilm $4.50; Xerox $15.20. 352 pages.

THE FREEHOLDER BY JOSEPH ADDISON: A CRITICAL EDITION BY ROBERT HILL LYNN.

(L. C. Card No. Mic 59-4235)

Robert Hill Lynn, Ph.D.
University of Virginia, 1959

In 1715 Joseph Addison began his last important periodical, the Freeholder, which was written in an effort to stem the rising tide of disaffection toward George I and the growing public sympathy for the claim of James Stuart to the throne of England. The Freeholder was frankly a party assignment: in it Addison, writing with charm, wit, and quiet rational appeal, set out to vindicate the political conduct of the Whigs - especially in the ratification of the Hanoverian Succession - and to discredit the Tory allegation that the reign of George of Hanover could result only in the moral and political ruin of the British nation. So successfully did Addison accomplish his purpose that there can be no doubt that the Freeholder contributed materially to his apogeal reward in the post of Secretary of State.

In the fifty-five issues of the Freeholder Addison employed the technique which had been perfected during the careers of the Tatler and Spectator and produced a periodical which is distinguished for at least two things: (1) the absense of party passion in an age when political faction ran its heedlessly violent course and vituperation and scurrility were the stock-in-trade of the average political writer; and (2) its lucid summary of the "rational" political theory of the day. Addison is neither a profound nor an original political thinker, but as a synthesist of classical political thought and as an apologist for the liberal ideology of his time his work deserves attention. The bulk of his political thought stems from two sources: (1) the writings of the Stoic political philosophers who first formulated the great principle of natural law, and (2) the writings of John Locke, the great apologist for the seventeenth century struggles for constitutional liberties, human rights, and toleration. To the first, Addison added a Christian apologetic; to the second, he gave his unqualified acceptance of the principle that the state exists solely for the welfare of its citizen members. Upon this foundation, Addison rears his argument that (1) as the Hanoverian Succession has been ratified by a lawful Parliament it has a moral and legal right to the support of the people of England, and (2) any attempt at rebellion against a rational government is an attempt to disrupt the orderly moral fabric of the universe.

It would, of course, be a mistake to claim for the Freeholder those qualities which have contributed to establish Addison's lasting literary reputation. There are naturally many touches which remind the reader of the Addison of the Spectator - the tolerant, urbane, slightly detached observer of the full tide of London existence - but in the final analysis the Freeholder must remain an organ which was conceived and executed for the practical purpose of discussing Whig policy and national issues and of recalling a nation to political sanity during a time when the throne of George of Hanover trembled, however briefly, upon its foundation. Microfilm $4.65; Xerox $15.60. 364 pages.

THE DIALECTIC OF TRAGEDY: HEROIC INTEGRITY IN SHAKESPEARE, SOPHOCLES, AND CORNEILLE.

(L. C. Card No. Mic 59-4026)

Leonard Jerome Moss, Ph.D.
Indiana University, 1959

Hegel's theory of tragedy is probably indispensable for the modern student of drama, except when it serves as the authoritative source (usually unacknowledged) of the recurring generalization made by many recent literary critics to the effect that Greek tragedy is ethically explicit and positive, in contrast to the ethical vagueness and inconclusiveness of Shakespearean tragedy. According to Hegel, in his lectures on aesthetics (1820-29), Greek tragedy exhibits an ultimate unity of the three essential dramatic elements: self-directed drives of the individual toward personal gratification; ethical codes of family, church, and state; and the Absolute, or rational totality of conflicting beings and values. Modern drama, including Shakespeare, on the other hand, presents the triumph only of the first element.

A study of major plays of Shakespeare (Hamlet, Othello, Macbeth, and King Lear), Sophocles (Ajax, Antigone, Oedipus Rex, Philoctetes, and Oedipus at Colonus), and Corneille (Le Cid, Horace, Cinna, and Polyeucte) bears out the Hegelian assumption that the protagonist is intensely loyal to a code of honor, although this loyalty is sustained by the hero's pride in his own "personal" abilities as much as by belief in preformulated standards of noble behavior. Heroic integrity (faith in self and in honorable principle), the basic presupposition of the tragic situation, is subjected to various kinds of challenge. Corneille offers an image of the protagonist successfully maintaining his conception of character-excellence, to the extent that the term "tragic" is hardly appropriate. In contrast, the Sophoclean hero, while equally uncompromising, suffers the loss in some measure of his society's moral support; it is isolation from others, rather than admiration by others, that allows his integrity to be defined. Supernatural intervention, furthermore, is important in the action, unlike the Corneillian drama. In Shakespeare, there is a more radically disruptive challenge presented to the hero, whose unity of purpose is destroyed by inward irrationality. However, a natural force of reason works to re-establish balance in the hero and his universe.

Hegel's insight concerning the difference between Greek and modern tragedy--that the distinctiveness of the first lies in its "objective" purpose of vindicating ethical reality, while that of the second lies in its "subjective" purpose of analyzing unique characters--is therefore an oversimplification of an important truth. Both the Sophoclean and Shakespearean plots recur in certain definite patterns that reflect the consequences of the challenge to integrity, but where the former is expressed in "institutional" terms involving the interaction of heroic, social, and divine laws, the latter is expressed in "psychological" terms involving the interaction of passion, noble will, and natural reason: the difference is between contexts of dramatic action. The dialectics that emerge from both tragedies respect the egoistic human energies as well as the ethical, and celebrate the potency of divine powers, social and heroic standards of conduct, and the prideful "distinctive individual" in the interplay of extremes.

Microfilm $3.20; Xerox $11.00. 246 pages.

THE CHANGING CONCEPTS OF ENTHUSIASM IN THE SEVENTEENTH AND EIGHTEENTH CENTURIES.

(L. C. Card No. Mic 59-3716)

Abraham Phillip Persky, Ph.D.
Stanford University, 1959

The purpose of this dissertation has been (1) to examine the semasiological history of enthusiasm during the seventeenth and eighteenth centuries; (2) to examine the causes of the changes in meaning; and (3) to indicate the significance of these changes to the literature of the period. The basic problems of meaning have suggested a semantic approach based upon the principles of Alfred Korzybski's general semantics and Arthur Lovejoy's concept of a "unit-idea."

The dissertation begins with an examination of the entries for "enthusiasm" and its variants in the dictionaries published in England between 1604 and 1755. These entries serve to point out the "norms" of meaning at a particular time during the period and to suggest the effect of changes in literary thought.

The earliest meaning of enthusiasm, which derives from the Greek work Entheos, "possessed of a god," and the Roman phrase furor poeticus, poetical fury, remains constant throughout the seventeenth and eighteenth centuries. Thus, poetic enthusiasm during this period refers to the divine afflatus traditionally associated with artistic creation. Three additional categories of meaning established early in the eighteenth century remain relatively stable: (1) excess of passions; (2) an "elevation of fancy" or "exaltation of ideas"; and (3) "confidence of opinion" or "support of a cause."

Religious enthusiasm develops from a relatively simple concept--the "inner light"--into a complex of ideas permeated with pejorative and strongly emotional overtones. By mid-eighteenth century the word "enthusiast," retaining its basically religious signification, becomes so much a catch-all label that it serves to indicate general disapproval and condemnation of any excess. Only John Byrom, in his poetic essay "Enthusiasm" (1751), points out that writers often use the term "enthusiasm" with complete disregard for its denotative meaning in order to arouse the strongest emotions in their readers. Byrom states that all men are enthusiasts in those things and ideas to which they give their approval.

Two writers at the beginning of the eighteenth century have a profound effect on the semasiological history of enthusiasm. John Dennis introduces enthusiasm as an explicitly literary and aesthetic term, and treats enthusiasm as synonymous with violent or extraordinary passions. The third Earl of Shaftesbury introduces the conception of enthusiasm as the divine inspiration arising from the contemplation of the beauty and order of the universe, and that of the "enthusiast" as the "Lover of Nature."

Shaftesbury's concept of the "moral sense" is elevated by Francis Hutcheson, David Hume, and Alexander Gerard to a position superior to reason. The word "taste" then becomes synonymous with the phrase "moral sense," and with this identification comes the acceptance of enthusiasm as a new criterion of aesthetic experience. Enthusiasm also becomes the emotion associated with the sublime. Such writers as Lord Kames, Hugh Blair, and James Beattie consider enthusiasm or "elevation of mind" to be the proper effect of contemplating the sublime, either in "nature" or in poetry.

Associated with these changing attitudes toward enthusiasm is a complex of ideas which becomes the basis for one manifestation of "Romanticism." The "enthusiast" becomes the "Lover of Nature" whose haunts are secluded bowers where, amidst the simplicity and solitude of natural surroundings, he finds "moral truth" revealed by a contemplation of "Nature" herself. The first complete characterization of this "romantic enthusiast" is found in Joseph Warton's poem "The Enthusiast or the Lover of Nature."

The dissertation concludes with an Appendix giving contextual usages of enthusiasm from 1662 through 1800 and illustrating the term's multitude of meanings.

Microfilm $2.50; Xerox $8.80. 192 pages.

SHAKESPEARE'S MYTHOLOGICAL INVENTION.

(L. C. Card No. Mic 59-3283)

John Robert Price, S.J., Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Madeleine Doran

Shakespeare's imagery, often studied since the early 1930's, mainly by appreciative critics, is here approached historically. The subject matter of the present essay is limited to classical myth and legend; its purpose is to understand Shakespeare's artistic use of this imagery in the light of historical backgrounds.

The thesis is divided into two parts: the first investigates the problem of the "sources" of Shakespeare's knowledge of commonplace imagery; the second part, Shakespeare's knowledge and use of mythological imagery.

The first part (Chapter I) notes the division between appreciative and historical critics and surveys the various kinds of source study. The author contends that many of Shakespeare's images are commonplace, and consequently no single source can be identified as the one from which he borrowed. This contention is supported by a study of Renaissance rhetoric and by a consideration of several images, the precise source for which had been identified. From rhetoric the Renaissance author learned both the rules for eloquent writing and many of the commonplace images to be used in his invention. Invention is the heart of rhetorical composition: it implies not only the art of "finding materials" in various commonplaces, but also the art of "dynamically" relating the interconnected lessons in rhetoric, and the art of "creatively" making commonplaces and rhetorical rules serve one's own expression. Considering several commonplace images in Shakespeare's plays, I show that it is immaterial to decide from what place an author borrowed a commonplace image. The important question is, what is the traditional humanistic and rhetorical value of the commonplace image? When the traditional value of an image is uncovered, considerable light is thrown on Shakespeare's use of the image. These general principles are applied to the garden-image and world-stage image in several plays.

The second part of the thesis (Chapters II, III, and IV) is an investigation of Shakespeare's sources of mythological imagery ("material" invention), his grasp of the interconnection of rhetorical rules and illustrations ("dynamic" invention), and his adaptation of rhetorical rules and commonplace illustrations to the theatre ("creative" invention).

The conclusions which may be drawn from the investigation are five. First, neither Golding nor the simple text of the Latin Ovid stands out as the principal identifiable source of Shakespeare's knowledge of classical mythology. Secondly, the humanistic and rhetorical values of mythological imagery are revealed principally in the rhetoric books used in grammar school. New light is thrown on Ovid and Virgil as teachers of rhetoric. Thirdly, in his use of mythology, Shakespeare shows a profound grasp of the interrelation of the lessons in rhetoric. Fourthly, Shakespeare did not regard mythological imagery as simply decorative, unoriginal, trivial, or artificial, as is sometimes supposed; rather, he used mythology as example and comparison in persuasive discourse, in praise, denunciation, chreia, moving description, and appeal to pity; he used it to heighten the emotion of a situation, to portray expressionistically the passion of a speaker, and to support the atmosphere of a story. Fifthly, Shakespeare's art is rooted in rhetorical invention; his originality lies in his thorough exploitation of rhetorical theory and his own creative adaptation of commonplace imagery to the theatre.

Microfilm $3.85; Xerox $13.00. 300 pages.

THE CRITICAL REPUTATION OF THOMAS LOVE PEACOCK WITH AN ANNOTATED ENUMERATIVE BIBLIOGRAPHY OF WORKS BY AND ABOUT PEACOCK FROM FEBRUARY, 1800, TO JUNE, 1958.

(L. C. Card No. Mic 59-3908)

Bill Read, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor John F. Leisher

The aim of this dissertation is to establish a definitive enumerative bibliography of the poetry, fiction, and literary criticism of Thomas Love Peacock; to establish an annotated enumerative bibliography of the criticism of Peacock which is as complete as possible through June, 1958; to determine the successive critical attitudes towards the works of Peacock from February, 1800, to June, 1958; and to identify the major critical articles and books so that later scholars of Peacock may be sure of not overlooking any important items.

The need for this study is evident when one knows that all existing Peacock bibliographies are unsatisfactory. The most scholarly as well as the most widely used are deficient. The Cambridge Bibliography of English Literature (including the 1957 supplement) lists three translations of Maid Marian, but omits both the French and German translations of the more important novel Nightmare abbey. The standard A Literary History of England, edited by A. C. Baugh, is obsolete in listing, as a convenient edition of the novels, an unannotated two-voluem edition of 1905, long unavailable; the appearance of the History in 1948 precluded listing the excellently annotated one-volume 1948 edition of Peacock. If the scholarly works are deficient, the more popular reference books are often downright wrong. The Encyclopaedia Britannica (editions of 1956, 1957, and 1958) prints "A. B. Joung" for "A. B. Young," choosing the least valuable (indeed positively the worst) of the seven available critical-biographies.

Concerning the quality of the critical studies one may say that the works by A. B. Young (the oldest book on Peacock) and that by O. W. Campbell (the most recent) should both be dismissed as being of very little value. The most extensive critical study is that by Jean-Jacques Mayoux, although this work is marred by an extremely unreliable bibliography. The most incisive critical studies are those by Augustus H. Able III and Jack Barry Ludwig, the latter being an unpublished dissertation. The best critical biographies are those by Carl Van Doren, Alexander M. Freeman, J. B. Priestley, and Benvenuto Cellini. Of these Van Doren is best in his biography, Freeman in relating Peacock to his contemporaries, and Priestley in his original critical insights. Cellini supplies nothing new except his emphasis on the ironic intent of Peacock.

The only satisfactory source for a complete biography is the work of H. F. B. Brett-Smith, although this is written

in a disagreeably dry style and omits all discussion of the intellectual milieu. The above-mentioned biographies by Van Doren and Priestley are good but both have been rendered obsolete in certain details by the work of Brett-Smith.

Peacock has not been the subject of many first-rate articles. For the negative view, the most interesting is that by Ronald Mason. For a positive view, the best articles are those by James Spedding, George Saintsbury, Clive Bell, and Edmund Wilson.

The best edition of the complete works, as is well known, is the Halliford Edition edited by H. F. B. Brett-Smith and C. E. Jones, a limited edition now long out of print. The best annotated edition of the novels is that prepared by David Garnett.

The successive critical attitudes towards Peacock's work are discussed in the essay and in the annotations to the 422 items which comprise the present bibliographical study. Microfilm $3.80; Xerox $12.80. 293 pages.

FREDERIC HARRISON: THE EVOLUTION OF AN ENGLISH POSITIVIST, 1831-1881.

(L. C. Card No. Mic 59-4089)

Martha Salmon, Ph.D.
Columbia University, 1959

This study traces the intellectual development of Frederic Harrison up to 1881, when at the age of fifty he became a leader of one group of British Positivists. Harrison's religious beliefs fell away at Oxford early in the 1850's, and he became interested in the Positivist philosophy of Auguste Comte, which he read about in works by Emile Littré, John Stuart Mill, George Henry Lewes, and Harriet Martineau. Comte's theory of religion as a phenomenon of the childhood stage of man's thinking seemed to Harrison to explain his own religious experience. While reading for the bar in London, he studied the volumes in which Comte had outlined the religion of Positivism, and though he did not accept this part of Comte's work for two decades, he soon became known as a Positivist. In 1860 Harrison published his first important work, an article in the Westminster Review denouncing the liberal theology advanced in Essays and Reviews. His criticism of the book was based on Positivist principles, but many people who were not Positivists shared his opinion of the volume, and his article caused a storm of controversy within the Church.

Since his object was to apply Comte's principles to contemporary life, Harrison's activities often led to his association with men who were either indifferent or hostile to Positivism. Though he no longer considered himself a Christian, he taught at the Working Men's College under F. D. Maurice, the Christian Socialist. As the friend and legal advisor of London trade union officials, he helped unions obtain legal status and security for their funds, though few union members subscribed to all his social and economic theories. His Fortnightly Review articles on political economy were widely discussed, and they won the praise of John Ruskin, whose biography he later wrote.

Early in his career Harrison advanced Comte's historical theories by lecturing in a secularist hall, by replying to Goldwin Smith's attack on the idea of scientific history, and by reviewing Henry Maine's Ancient Law in the Westminster. Towards the end of his life, he published many historical studies.

Like his conception of history, Harrison's politics show the influence of Positivism, for he was a republican, an anti-imperialist, and an advocate of a strong executive. His support of Parliamentary reform in 1867 led to the controversy with Matthew Arnold which is alluded to in Culture and Anarchy, and his later articles on political topics provoked replies from his friends Leslie Stephen and John Morley. Ardently pro-French, he urged British aid to France in 1870, defended the Commune in 1871, and wrote numerous articles praising the accomplishments of the Third Republic. In spite of his close friendship with many leading Radicals and Liberals, he refused to become involved in party politics. He opposed Gladstone's anti-Turkish policy at the time of the Bulgarian atrocities, declaring it to be an expression of religious bigotry, but he supported Gladstone on Home Rule.

By 1881, Harrison had accepted Positivism as a religion, and in that year he retired from active legal practice to devote himself to advancing Positivism in England. Besides numerous essays and books on Comte's philosophy and religion, he wrote the literary criticism and the reminiscences of famous Victorians on which his reputation today is partly based.

Microfilm $5.40; Xerox $19.00. 423 pages.

IRONY IN EARLY CRITICAL COMEDY.

(L. C. Card No. Mic 59-3723)

Donald Ernest Soule, Ph.D.
Stanford University, 1959

The study is concerned with defining the nature and functions of irony as a technique of critical comedy. The problem is conceived as a composite one, comprising the following questions: 1) What do the origins of the word "irony" and of the figure of the ironist indicate of the general nature of irony? 2) What are the particular characteristics of irony as a verbal technique? 3) What is the general function of irony in drama? 4) What are the characteristics and functions of irony in traditional tragedy, and what relations do these bear to critical comedy? 5) What in the nature of critical comedy makes it a form particularly suitable for the employment of irony? 6) How has irony been used in some early kinds of relatively "pure" critical comedy? It has been assumed that the answers to these questions would provide at least a preliminary solution to the problem of irony's functions in critical comedy generally.

The discussion is divided into two main sections. The first includes historical and theoretical definitions of irony in several dramatic forms, and of critical comedy as a form. The second division is composed of analyses of the use of irony in three kinds of early comedy: Old Comedy, Jonsonian satirical comedy, and Roman comedy. It was felt that by examining these forms conclusions might be reached which would also have some validity with respect to later, less homogeneous kinds of comic drama.

After an introductory explanation of the technical

orientation of the study, the first division begins with a description of the earliest usages and meanings of the word "irony" and of the first systematic use, in Plato's Socratic dialogues, of verbal irony as a critical technique. There follow brief, general descriptions of the nature of the ironist and verbal irony, and of irony's function in drama. Tragic irony is then examined in a number of representative Greek and Elizabethan tragedies, and the relation of tragedy to critical comedy, with special reference to irony, is suggested. The first section concludes with a discussion of the characteristics of critical comedy and their relation to those of irony.

The second portion of the study comprises analyses of verbal irony and irony of event, as well as something of the character of the ironist, in the comedies of Aristophanes and of Ben Jonson. An intervening note on the non-critical use of irony in Roman comedy is intended to bridge the formal and historical gap between the first two, and to serve as a kind of control in the study. The final chapter is a brief summary of irony's characteristics and kinds of irony which have been distinguished.

It is concluded that irony is essentially critical and negative in nature and intent, is intended to exploit (and thus criticize) the ignorance of its victim, and to communicate primarily, though indirectly, with an audience. Within the general categories of verbal irony and irony of event, several distinctions are made: 1) between "negative" and "positive" irony, according to whether the hidden, true meaning is negatively or positively intended; and 2) between what may be called "anticipatory", "retrospective", and "simultaneous" irony. Of these three, the first requires definite audience foreknowledge; the second is an outcome contrary to expectation, not requiring ignorance in the victim but involving a comparison of present circumstances with past expectations; the third demands ignorance in the victim and a comparison by the audience of elements presently existent in the dramatic situation.

Microfilm $5.65; Xerox $19.80. 443 pages.

THE SOCIAL IMPLICATIONS OF THE WRITINGS AND THE CAREER OF JAMES WELDON JOHNSON.

(L. C. Card No. Mic 59-2092)

Ernest Cater Tate, Ph.D.
New York University, 1959

This study is an investigation of the socio-economic and political implications of the writings and the career of James Weldon Johnson.

The basic problem was to discover and to evaluate the findings in the light of their probable influence upon the betterment of race relations in America.

The major problem was broken down into the following supplementary problems: (1) What ideas are necessary to the achievement of better relations between white people and Negroes in America? (2) How can Johnson's part in the achievement be determined? (3) With what contemporary writers can Johnson be compared? (4) With what organizations and agencies can Johnson be identified?

The study determines the pertinent historical facts which are involved in the racial conflict and adjustment between the American whites and Negroes. To a large extent, the Negro is controlled by the social codes and social attitudes evolved from the slave economy.

A study was made of the historical background for racial conflict between Negroes and whites in America. Then, an examination was made of the period of Johnson's life in an effort to discover the main trends both in the socio-economic background and in the literary background. Next, Johnson's own life was studied in order to discover the relationship of the happenings in his own life to those of the times.

All of Johnson's contributions were examined in the light of background material gathered from the historical, social, and critical studies already analyzed. Johnson's ideas for racial adjustment were compared with those theories of other social thinkers in an effort to discover the types, the trends, and the growth of the consciousness to the Negro problem and the reactions to it. The continuing influences were also studied in order to place Johnson in a proper perspective with respect to the movements of his time--social, economic, political, and literary.

The primary sources including all the poetry and prose writings of Johnson, his lectures and newspaper writings, and his unpublished manuscripts, letters, and scrapbooks were examined.

The secondary sources--both in literary criticism and in historical background--were also studied.

Personal conferences with Rosamond Johnson, Car Van Vechten, Sterling Brown, Walter White, and other friends of Johnson helped to give an adequate picture of James Weldon Johnson as an individual. In its conclusions, this study found essentially the following facts:

1. The contributions of James Weldon Johnson show some of the social forces at work in the early part of the twentieth century-- and a study of these forces is significant in understanding social trends and forces in present day society.
2. Johnson's writings give an implied and expressed criticism of American society with respect to justice for the American Negro.
3. The literary work of Johnson laid the foundation for writers and artists of the early twentieth century, referred to as the "Negro Renaissance."
4. The Negro would probably have been less emotionally and mentally prepared for the new generation if Johnson had not encouraged his people to have racial pride and confidence in themselves.
5. A group of Negro and white writers continue to point out the anachronism of a half-man in a democratic society; another group is beginning to view the American scene in terms of national cultural perspectives rather than in terms of racial inequalities.

The study places under one cover Johnson's many ideas for social reform which have heretofore appeared only in scattered form. These records are important for students seeking an insight into the making of America. Moreover, they reveal the fact that race consciousness will continue to function as the main force in the socio-economic, and political activity of the Negro until he is given full citizenship rights in American society.

Microfilm $2.30; Xerox $8.00. 173 pages.

FATE IN THE NOVELS OF ZOLA AND COUPERUS; A COMPARISON WITH THE GREEK CONCEPT OF FATE.

(L. C. Card No. Mic 59-3058)

Eldad Cornelis Vanderlip, Ph.D.
University of Southern California, 1959

The purpose of this study is to set some aspects of fate found in Greek literature beside related aspects in the novels of two modern European writers, Émile Zola and Louis Couperus. It is not the intent to show that the treatment of the subject by these writers was similar or consistent. This study arises naturally out of the contemporary reappraisal of these writers which finds them much more concerned with the emotional life than previous criticism had allowed.

Fate in Greek literature developed from a personal to an impersonal concept. Originally identified with three fatal sisters who controlled the destiny of man (as in Hesiod), fate became an expression for the experience of limitation and mortality in life, for the feeling that something was throttling the divine in man and restricting his achievement and joy. Whereas in Homer and the tragedians the gods, in general, aid man, fate runs counter to human attainment. In these Greek writers, fate is the negative aspect of man's existence—his limitation (and destruction) by natural law; fate is not a supernatural power.

Homer and the tragedians humanized and rationalized the myths. They used them to give perspective and to objectify and universalize essentially subjective experience. Although fate seems to be identified at times with the will of Zeus, it is radically different. Zeus himself must bow to fate—life and achievement must give way to death and disintegration.

At the turn of the century, Zola of France and Couperus of Holland each wrote a series of family novels in which they described the reaction of the characters to destructive and limiting forces. The Rougon-Macquart and Small Souls series are concerned with the subjective experience of fate by the characters, rather than with the demonstration of a pseudo-scientific theory of heredity and environment. The milieu interprets and symbolizes man's emotional life in his conflict with limiting and atavistic forces. The family structure provides depth and perspective.

Conclusions. The novelists compare with the Greeks in their use of symbol to portray human experience. Like the Greeks, the novelists focus on the human situation and do not picture fate as a supernatural power. Fate is identified with limiting forces expressed by natural law. The treatment of fate by Zola and Couperus allows for an analysis of the emotional life of the characters and serves the functional purpose of social criticism. In both series the functional and the aesthetic are merged.

Microfilm $2.35; Xerox $8.20. 177 pages.

THE ELIZABETHAN HISTORY PLAY: A STUDY OF ITS TYPES AND DRAMATIC TECHNIQUES.

(L. C. Card No. Mic 59-3727)

John Marvin Wasson, Ph.D.
Stanford University, 1959

Although interest in Elizabethan history plays has been revived recently, there is still no satisfactory definition of them, and more important, no critical standard by which to evaluate them. Just as even the best tragedies are more understandable in terms of the genre "tragedy," so one can better interpret history plays when one knows what a history play is and what it is supposed to accomplish than by studying them only as isolated plays, or even in terms of other types of plays by the same author. Further, in the absence of accepted standards, many history plays have been condemned or found wanting because they were judged by standards not their own -- usually those of tragedy. The purposes of this dissertation, then, are to set up, through the methods of historical criticism, both a working definition of history plays and a means of evaluating them, and to examine the extant history plays to discover the methods and degrees of success of the playwrights in attaining to these standards.

The excellence of a history play is dependent neither on its relative fidelity to facts nor on the relative clarity with which the moral, if there is one, is propounded. The play's worth must be determined, rather, by the degree to which historical elements are assimilated into an effective stage drama having unity and coherence. The playwright's use of fictional materials and his rearrangement of facts were perfectly acceptable methods of achieving unity and should not affect adversely an evaluation of his play. His major task was to select, from a mass of historical details, interesting and significant facts and to arrange them into a probable cause-and-effect relationship with few or no historical loose ends.

Because most Elizabethan tragedies were also based on historical fact, a distinction between histories and tragedies must be made on the bases of the differences in the handling of those facts and the apparent ends for which the material was organized. A play based on history is not to be regarded as a tragedy merely because it happens to contain a death -- unless that death and its causes are the main concern of the play. A tragic playwright's major concern was to probe deeply the character of the hero and to portray either his tragic weakness or his attitude a tragic situation. The history playwright would give the same character a broader and, ordinarily, less penetrating analysis, and he would concentrate his efforts toward establishing a unifying principle for a sequence of events which may have had little or no historical connection other than chronological. The difference in approach becomes evident in a comparison of such related plays as Richard II and Edward II.

The dissertation shows further that history plays were not limited in subject to English history, as is often assumed. Biblical, ancient, and modern European history also provided suitable subject matter; David and Bethsabe, The Wounds of Civil War, and A Larum for London are just as surely history plays as is Shakespeare's Henry V.

Finally, this study shows that history plays were considerably less influenced than were tragedies by moralities,

Roman tragedy, and "de casibus" tales. Mystery plays and folk plays seem to have been the greater influences. There is some evidence for a steady, rather than abrupt, development of the Elizabethan history play.
Microfilm $4.65; Xerox $15.60. 363 pages.

LANGUAGE AND LITERATURE, LINGUISTICS

A GENERATIVE GRAMMAR OF A DIALECT OF ILOCANO.

(L. C. Card No. Mic 59-3995)

Ernesto Andres Constantino, Ph.D.
Indiana University, 1959

This is an attempt to construct a generative grammar of a dialect of Ilocano, a Philippine language, that is a grammar which aims to provide a means for automatically generating sentences of the language.

This grammar has been constructed so as to generate all and only the grammatical sentences of the language. We did not set up in this grammar such a notion as 'degrees of grammaticalness.' To us, a sentence is either grammatical or it does not belong to the language, i.e. it does not conform to the rules of the grammar of the language. The rules and classes have been so designed that an end-product of the grammar should be acceptable to a native speaker, and as far as possible we have not excluded any such sentence from consideration.

This grammar is divided into three parts arranged as follows: 1) Phrase Structure, 2) Grammatical Transformations and 3) Morphophonemics. These three parts correspond exactly to the three linguistic levels which we designate by the same names.

Each of the three linguistic levels has a set of rules. They are 'instruction formulas' of the form a→ b interpreted: rewrite a as b. Three types of rules can be distinguished: 1) Expansion rules, 2) Listing rules, and 3) Transformational rules.

The rules of this grammar are either obligatory or optional. Obligatory rules are those that must be applied whenever we reach them in the process of generating a sentence. Optional rules do not have to be applied in order to generate a sentence.

To generate a sentence from this grammar, we construct an extended derivation beginning with the initial string Sentence. Running through the phrase structure rules we produce a string of morphemes; we call this string a terminal string. We then run through the sequence of transformational rules and apply each obligatory rule and perhaps certain optional ones. The transformational rules may add or delete morphemes, or they may change the order of the morphemes in strings. As a result they yield a rearranged string of morphemes. We then run through the morphophonemic rules and end up with a string of phonemes.

Also included in this grammar are three sentence derivations, a sample lexicon which contains a list of about 4000 morphemes properly identified for use in sentence generation, and two appendices: 1) A Phonemic Analysis of Ilocano, and 2) A Generative Phonological Grammar of Ilocano. Microfilm $2.75; Xerox $9.60. 212 pages.

OLD ENGLISH MORPHEMIC STRUCTURES: A GRAMMATICAL RESTATEMENT.

(L. C. Card No. Mic 59-4027)

George McCormick Motherwell, Ph.D.
Indiana University, 1959

OE Grammars written by 19th century German scholars, e.g., Eduard Sievers' Angelsächsische Grammatik and P.J. Cosijn's Altwestsächsische Grammatik, are diachronic (historical) rather than synchronic (descriptive) in their approach to the subject. British scholars such as Henry Sweet and Henry Cecil Wyld have also viewed problems of the analysis of OE phonology and grammar primarily from a historical viewpoint. It is generally agreed among modern students of language that both historical and descriptive studies are valuable and important but that the two approaches are to be consistently distinguished, and that study of the historical development of a language is ideally based upon a series of synchronic statements. The only OE grammar which recognizes and employs some of the principles of modern linguistic analysis is that of Randolph Quirk and C. L. Wrenn, An Old English Grammar (London, 1958); this grammar, however, while presenting nouns in descriptive terms, analyzes verbs on the basis of the traditional historical classification of verbs of Germanic languages into seven classes and is to this extent eclectic in its approach to these two morphological categories.

This study is an attempt to analyze the principal morphological properties of Old English nouns, verbs, and adjectives from a point of view which is consistently synchronic in so far as this is possible for a language existing only in the form of written records diverse in terms of dating and location as are OE MSS. It is intended as a restatement of grammatical analyses of the former grammars of OE from which it is derived and is valid to the extent of accuracy in recording forms from OE MSS and other studies attained by writers of these grammars.

All OE grammars written to date are, in explicit or implicit terms, normalized in time and location. The period most favored by students following Henry Sweet has been that called "Early" and dated c. A.D. 700-900; the dialect most favored has been West Saxon. More recently the concept of the early period's being best suited to grammatical analysis has been questioned, particularly by C. L. Wrenn, although scholars still agree that West Saxon sources should be used. This study reviews some questions of normalization and adopts the notion of "Classical" OE of c. A.D. 1000 advanced by Quirk and Wrenn as a period better suited to grammatical analysis than that of Early West Saxon; it adopts a phonological analysis of OE posited in terms of modern structural linguistics studies by Robert P. Stockwell and proposes an analysis of verbs, nouns, and adjectives based upon this phonology. It is a grammatical restatement in synchronic terms of previous treatments of the West Saxon dialect of OE normalized to the period of Aelfric. It is made for the ultimate purpose of providing a basis, in terms more scientific than those

of former studies, for statements of the subsequent historical development of the English language.

Microfilm $2.10; Xerox $7.40. 157 pages.

LANGUAGE AND LITERATURE, MODERN

THE RECEPTION OF THE AMERICAN NOVEL IN GERMAN PERIODICALS. (1945-1957).

(L. C. Card No. Mic 59-3986)

Sara Elizabeth Ballinger, Ph.D.
Indiana University, 1959

The reception of the American novel in Germany since 1945 was studied through a survey of criticism in nineteen German periodicals and two newspapers. In an attempt to sample the critical opinion reaching German readers of varying cultural levels, such periodicals as Universitas, Die Neueren Sprachen, Merkur, Frankfurter Hefte, Deutsche Rundschau, and the East German Aufbau were included.

The history of the American novel in Germany was traced from its breakthrough in the first half of the nineteenth century, when Cooper and Irving were first translated, through the Harriet Beecher Stowe and Mark Twain era, to the period of rising interest at the turn of the century. This trend was climaxed in the Twenties with the popularity of Sinclair Lewis and Upton Sinclair, followed by the introduction of the works of the members of the "Lost Generation" in the Thirties, and was later throttled by the outbreak of World War II.

The literary situation in postwar Germany was conducive to the influx of foreign literature and culture. During the twelve years following 1945, numerous American novels were translated into German. The book starved Germans were at first receptive to anything in print, but as the publishing business regained its prewar status, a more discriminating reading public emerged.

German readers were very much interested in learning about the United States and looked to the American novel for an Amerikabild. The realists of the Thirties became popular to some extent because of the picture of American life in their works which enriched the ideas the Germans already had. Soon, however, a more pronounced interest arose in the American writer as a person and in his works as literature, rather than as handbooks of the United States. This interest culminated in the German fascination with Faulkner, Wolfe, and Wilder as well as with the late novels of Hemingway and Steinbeck. At this time also the nineteenth century novelists Henry James and Herman Melville were rediscovered in Germany after having been ignored for many years. The critics became more discriminating in their discussions of these writers, and the reviews and articles began to show a deep insight into American literature.

The young writers of the postwar generation were also translated. The Germans were especially interested in the war novelists, but they found them inferior to Hemingway and Dos Passos, who had depicted World War I. The critics seem to be concerned about the future of the American novel in the hands of the young writers, who, they feel, lack the courage to meet the challenge of modern existence.

German critics are of the opinion that the American novel reached its highest form in Wolfe, Faulkner, and Hemingway, and include these writers along with Melville and James among the classics of world literature. It is not surprising, then, that American literature is finally being accepted into the German university system as a subject of serious consideration.

Microfilm $2.20; Xerox $7.80. 167 pages.

THE SIXTEENTH-CENTURY ANABAPTISTS AS A THEME IN TWENTIETH-CENTURY GERMAN LITERATURE, (1900-1957).

(L. C. Card No. Mic 59-3989)

Mary Eleanor Bender, Ph.D.
Indiana University, 1959

The twentieth century has witnessed an unprecedented interest in the left wing of the Reformation and especially in Anabaptism. New historical research has shown that what once was considered a "diabolical heresy" was in fact an important channel in the stream of Christian thought. Thus Anabaptism has gained increasing relevance for the contemporary theological scene. The present dissertation is an attempt to discover in what ways the interest in Anabaptism among historians and theologians has been reflected in the German literary world.

To achieve this goal, three steps were found necessary. (1) The historical background was sketched in the light of new historical data and interpretations, clarifying at least the difference between evangelical Anabaptism and the notorious Münster episode. (2) Of the thirty-one German belletristic works on Anabaptism which have appeared in the twentieth century, fourteen, considered most important, were analysed in detail; (3) the rest were reviewed briefly. The analyses consist largely of a critical evaluation of each author's interpretation of Anabaptism, of the presumable reasons for his attitude, and of an appraisal of the literary quality of his work.

Quantitatively, the thirty-one twentieth-century works represent a striking increase in the use of the Anabaptist theme, since only thirty-four had appeared in the previous four centuries. Even more marked is the increase in the treatments of evangelical Anabaptism proper, of which twice as many (twelve) have appeared since 1900 as before 1900. Equally noticeable is a change in tone. All the literature written since 1900 reflects clearly a positive attitude toward Anabaptism. However, the new historical or theological insights are seldom reflected in this new literature.

The appeal of the Münster theme remains, as it has always been, largely one of sensationalism, with emphasis on the motivation of its leaders. Works which transcend the level of sensationalism treat the Münster episode as an epitome of post-medieval dissolution of form in which to study "modernity" or as a prototype of National Socialism. In Friedrich Dürrenmatt's important drama Es steht geschrieben (1947), Münster represents not only chaos but also the possibility of faith within chaos. Only one of the eight works on Münster studied in detail (Bernhard

Kellermann's drama Die Wiedertäufer, 1935) distinguishes between the evangelical Anabaptists and the Münsterites. The rest present all of Anabaptism much as it has been traditionally regarded, as social revolt perverted by chiliastic mysticism with its climax in Münster.

The literary interest in the evangelical Anabaptists is not primarily in its theology, but in the superficial aspects of its nonconformist, "modern" ethic. Most of the works exploit Anabaptist ethics tendentiously, as they support such goals as democratic social structure, tolerance and brotherhood, or even a Germanic "folk" church. The evangelical Anabaptists are presented with great disparity as voluble mystics, social revolutionaries, anti-pietistic activists, or Nordic heroes. Only Caesar von Arx's Brüder in Christo (1947) may be said to combine profound insight into historical evangelical Anabaptism with a high degree of literary excellence.

Eight years after the two Swiss dramas (Arx's and Dürrenmatt's) a major novel by the Austrian F. T. Csokor, Der Schlüssel zum Abgrund, presented Münster as an island of form in post-medieval chaos, illustrating the most important contemporary appeal of Anabaptism: the appeal of uncompromising faith to an age of relativism and doubt. Apart from the four works singled out most of the authors contributing to our theme can have little pretense to literary distinction.

Microfilm $3.40; Xerox $11.60. 262 pages.

FORREST REID AND THE GREEK WORLD: A STUDY OF HIS NOVELS.

(L. C. Card No. Mic 59-3454)

Mary Catherine Bryan, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Edward Wagenknecht

Forrest Reid (1876-1947), an Anglo-Irish novelist from Belfast, critic of art and literature, and translator of poems from the Greek Anthology, is one of the most imaginative and significant minor modern novelists, although he has remained comparatively unappreciated in America.

Because of his complete individualism, his dedication to his art, and his personal vision of reality, he cannot be identified with any literary movement or school. Reid is essentially a romantic and a visionary who was so inspired by the Greeks that his Hellenism became a personal conviction as well as a literary convention.

By affinity, temperament, and interest Reid was attracted to Greece from his early schooldays. Through his reading in Greek mythology and Greek literature in the original, as well as in French and English translations, and through Anatole France whose works influenced Reid to pursue the Greek ideal and to write in "a more naked and Grecian manner," he became a Hellenist. So absorbed was he in the Greek way of life as he imaginatively reconstructed it that it became integral to his novels. Because of his recollections of a world from which he believed he came, more ideal than the present, Reid was led to adopt the Greeks and Greek idealism as his way of life in preference to Christianity.

In each novel Reid treats the problem of boyhood and adolescence, although it is the sensitive, imaginative, not quite normal boy who dominates his pages. Within these novels Reid uses Greek material such as myth, animism, Platonism, sculpture, and literature in different ways and in varying degrees to shape his vision. To ignore the prevailing atmosphere of the "Greek ideal" as he calls it, is to lose the deeper meaning of the novels.

The purpose of this dissertation is to show the extent to which these varied aspects of Greek antiquity influenced, shaped, and colored the vision of each novel.

This study is divided into six chapters and a conclusion. Chapter I deals with a portrait of the novelist as he reveals himself through his two spiritual autobiographies, Apostate (1926), and Private Road (1940). Since a subjective element is evident in his novels, Reid's life is of importance to an understanding of the values he asserts. Chapter II establishes Reid's literary background and indicates his relationship to his contemporaries and his times. Chapter III discusses Forrest Reid's mythopoeic imagination; it sketches the backgrounds of Hellenism in France, Germany, and England in order to place him in this tradition; and it further discusses the general concept of Hellenism in order to relate it to Reid's novels.

For purposes of this study Reid's fifteen novels have been divided into three periods following a chronological order, in order to show the emergence of the "Greek ideal" and his use of Greek material to a greater or lesser degree according to the demands of his subject.

Chapter IV includes the early novels from The Kingdom of Twilight (1904) to Following Darkness (1912) in which the Greek influence is strong and his style is testing its wings. Chapter V treats the middle years from The Gentle Lover (1913) through Pender Among the Residents (1922), a period in which Reid's use of Greek material is less pronounced because he was attempting to write a more popular type of novel and thus reach a wider reading public. After writing Apostate (1926), however, Reid's dedication to Greece became permanent. Chapter VI discusses the novels from Demophon (1927) to Denis Bracknel (1947). This later period reveals Reid's return to Greek themes and a corresponding growth stylistically in directness, simplicity, and lucidity because of his continued efforts to perfect his craftsmanship.

Each of the novels is analyzed in some detail with reference to subject matter, form, point of view, imagery, style, symbolism, recurrent image, thematic idea, and the influence of Greek antiquity on Reid's vision of life. In the discussion of the novels an attempt has been made to evaluate their artistic qualities and merits. Critical reviews of these novels are also examined to show the reception which they received upon publication.

The conclusion arrived at is that Forrest Reid is a significant minor psychological novelist and prose stylist whose imaginative treatment of the adolescent turmoil with its complex emotional distrubances is an important artistic contribution to twentieth century literature and that his Hellenism is integral to his vision of life. Forrest Reid's novels are highly imaginative, intensely human, and especially significant for the "matter of truth" which they convey. It is hoped that this attempt to see his novels as a whole, and the Greek influence reflected in them in particular, will contribute in some way to the recognition of Forest Reid as a significant Anglo-Irish novelist.

Microfilm $4.80. Xerox $16.00. 375 pages.

EVELYN WAUGH: HIS SATIRE, HIS IDEAS OF ORDER, AND HIS RELATION TO OTHER MODERN ENGLISH SATIRICAL NOVELISTS.

(L. C. Card No. Mic 59-4058)

James Francis Carens, Ph.D.
Columbia University, 1959

Evelyn Waugh, one of the most accomplished of a group of modern English satirical novelists, began his career with a series of satires which reflect the wasteland despair of the late nineteen twenties and of the 'thirties; as his commitment to Roman Catholicism and to an ideal of the aristocratic life deepened, these commitments became more explicit in his fiction. In this study I have undertaken an analysis of Waugh's works and have sought to relate them to the satirical tendency in the modern novel and to certain other important trends, religious and political.

Chapter One analyzes a number of dominant motifs in Waugh's novels in order to demonstrate the nature of the satirist's rejection of the contemporary world and the essential seriousness underlying his levity. Major divisions of the chapter are concerned with the image Waugh creates of his civilization as a wasteland of incoherence and absurdity; with the symbolic aristocratic house which he represents as threatened by social and moral incoherence; and with his development of a group of innocents, anti-heroes, and victims as central male characters.

Chapter Two evaluates Waugh's satiric range and the development of his satiric perspective up to Brideshead Revisited, his first explicitly Catholic novel. Finding that charges of snobbery, cruelty, and adolescence will not fully account for the nature of his satire, this chapter demonstrates that the early works were essentially destructive and negative, and sometimes ambivalent in attitude; it argues that of these early satires the assured and ironic A Handful of Dust was the masterpiece.

Chapter Three locates Waugh among those romantic writers who have been converted to Catholicism since the turn of the century; the chapter indicates that his traditionalist, rationalist, and anti-mystical Catholicism is reflected in Brideshead Revisited and Helena, two affirmative novels which represent a stage in the adjustment of his satirical impulse to a more conventional form. In the former work, which confuses social values with religious ones, satire is subordinated to sentiment; in the latter, it is the instrument of religious apology.

Chapter Four relates Waugh to the tendency to political rightism and distinguishes his idealization of civilized order from fascism. Black Mischief, Scoop, and other works are analyzed in terms of the satirist's idiosyncratic and disillusioned toryism. Men at Arms and Officers and Gentlemen, novels in his later manner, which reveal the moral collapse of England in the second World War, are seen as Waugh's most satisfying attempt both to expose folly and also to create positive values.

Chapter Five deals with Waugh and two "dynasties" of satirical novelists who emerged between the close of the first decade of this century and the late 'thirties. Though Waugh owes something to the tone of Norman Douglas, whose South Wind was the model for the conversational novel of Aldous Huxley, he was mainly influenced by the oblique satirical techniques of Ronald Firbank. Waugh shared both disenchantment and religious conversion with Aldous Huxley and rightist political enthusiasms with Wyndham Lewis, but his satire is neither intellectual nor didactic as is that of these men whom he joins in ridiculing the modern age. Waugh, whose principal follower in the Firbank "line" was Anthony Powell, attained a degree of craftsmanship which these other satirists did not often achieve. His satiric poise, though severely strained in certain of his later novels, gave him a staying power which his contemporaries lacked.

Microfilm $3.85; Xerox $13.00. 300 pages.

A STUDY IN EDDIC PROSODY.

(L. C. Card No. Mic 59-4217)

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University of Virginia, 1959

This study concerns itself with a critical examination of the Eddic metres, fornyrðislag, málaháttr, and ljóðaháttr, with special reference to the problems associated with the half-lines that Sievers has designated B, C, and A3 and of the full-line of ljóðaháttr. Moreover, a solution of these proglems has been proposed and a new method of scansion advocated.

It has been assumed that there is a fundamental relationship between the rhythm of verse and that of music and that the harp was originally used as a complement to the voice in the recitation of the early prototypes of the Eddic Lays. In fact, the metrical analyses have been made through the notations of music, since by this means both the quantitative relationships of the syllables of a verse to one another and also the stress-pattern of the verse can be accurately demonstrated.

First, it has been shown that the weak opening syllables of B- and C-lines, upon which primary stress cannot fall, can sometimes be conveniently brought into the metrical scheme of the verse by reading them within the time allotted the last measure of the preceding hemistich. But generally, a musical rest placed before the weak opening syllables serves as an expedient device for this purpose, marking definitely where the primary stress should fall. At this point the minstrel in his recitation of the early prototypes of the 'Lays' presumably would have struck a single introductory note on his harp. Also, the rhythmic structure of the whole verse of which these half-lines are perchance a part, may sometimes be such as to necessitate a change in the location of the bars that separate the individual measures of these half-lines and accordingly a different apportionment of the syllables to the individual measure from that of the normal pattern to attain the desired rhythm.

In A3-lines it has also been demonstrated that, if an initial rest be employed, it will give the verse a rising movement that fits harmoniously into its meaning. To this end the rest serves particularly well in the A3-lines that introduce strophes in which the sequence of ideas suggests a rising movement in their rhythm. In fact, the frequency of these lines in this position makes it reasonable to assume that they may have once been used exclusively at the head of strophes as an effective means of introducing an idea gradually and in climactic oredr.

All the illustrative lines of the B-, C-, and A3-types

are written in fornyroislag. The metrical schemes proposed for these types with the variations noted for each fit readily into the metrical patterns of the remaining types and their subtypes to produce a consistent and smooth rhythm. How easily and effectively the new method of scansion accommodates itself to the reading of continuous verse written in fornyroislag is illustrated clearly by a complete metrical analysis of Baldrs Draumar.

Metrical analyses of verses from the Atlamál written in málaháttr have also been made. Here too the new method of scansion advocated gives a smoother, more natural and unforced rhythm to the reading of this metre than do the traditional methods.

Finally, the proposed method of scansion has been successfully applied to ljooaháttr. The illustrative verses in this metre have been taken from the Hávamál and Lokasenna, and the analyses of them produce five general types of the full-line. These types have been described in detail with reference to the rhythms involved in each. Again, by the utilization of the metrical principles advocated the full-line becomes instead of a problem a verse finely regulated and richly varied in its rhythm.

Microfilm $2.60; Xerox $9.00. 200 pages.

THE LITERARY CRITICISM OF THE DIAL, 1920-1929.

(L. C. Card No. Mic 59-4108)

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Supervisor: Professor G. N. Bennett

The Dial, which was published monthly from January, 1920 until July, 1929, has been described as "one of the best advance guard magazines that ever existed in America." It has been said that "America learned from Dial critics more about the artistic process and more about the value of art as experience than it learned during our entire previous history."

The problem of the thesis was to identify and describe the precise contribution of the Dial to critical thought. The findings of the thesis are as follows. Although the editors of the Dial stated that they intended to pursue a policy of independent eclecticism, avoiding the influence of literary dictators and literary movements, in soliciting the views of Ford Madox Heuffer, T. S. Eliot, and Ezra Pound, the editors introduced into the Dial points of view which were more or less radically opposed to those which they had stated.

Heuffer argued that the literary movement, made possible by the close association of a group of writers who agreed upon certain principles, was an extremely valuable technique, giving a feeling of confidence and a sense of direction to aspiring writers and helping them to gain a more rapid hearing for their work than they could expect working alone. Heuffer thought that the literary review could best serve the cause of letters by presenting itself as the instrument of a literary movement, presenting some kind of "cohesion" of thought. In their earliest communications to the Dial Eliot and Pound implied that they agreed that the close association of writers presenting a certain "cohesion" of thought was a valuable, if not indispensable, literary technique.

The desire for "cohesion" of thought among contributors to a given periodical is, in effect, a desire for a climate in which dissent must necessarily be regarded as either irrelevance or ignorance or hostility toward the cause of letters. The Dial, without feeling the need to state a rationale for doing so, reflected such a climate. The literary critics associated with the Dial were strongly inclined to support the following principles: (1) the important literary work is marked by formal and stylistic virtuosity and innovation rather than by the importance of what it has to convey; (2) the important work conveys whatever it has to convey by means of images, avoiding the expression of ideas in conceptual form; (3) the important work reveals a sensibility on the part of the writer which manages to combine simultaneously feelings of attraction and aversion, avoiding unqualified enthusiasms and antipathies. Such protest as was made of these principles was scattered and ineffective.

It may be said, therefore, that the contribution of the Dial to critical thought was in helping to establish the prestige of the idea of the literary movement, not as a phenomenon identified by posterity who ascribe to writers a certain similarity of aim and method, but as a consciously practiced technique. It also helped to popularize what may be called the "form-image-irony" theory of literature, which has been regarded the basic theory of one of the most influential groups in modern criticism.

It has been said that the Dial helped to set the "standard" for certain periodicals which have succeeded it. To the extent that this observation is justifiable, it is to be expected that the literary criticism of such periodicals is marked by an awareness of the advantage of some kind of cohesion of thought, made possible by a willingness on the part of critics to speak to limited and more or less predetermined issues.

Microfilm $2.70; Xerox $9.40. 206 pages.

THE ROLE OF THE CRITIC IN THE RESTORATION AND EARLY EIGHTEENTH CENTURY.

(L. C. Card No. Mic 59-3558)

Elmo H. Howell, Ph.D.
The University of Florida, 1955

In the period from 1660 to 1714, which saw the triumph of neo-classicism in England, the critic received a measure of attention which he had never before enjoyed. Rule and decorum abstracted out of Aristotle, but most often out of his French commentators, made the critical function a simple one; and many simple men came forward to call themselves critics.

This species of small critics most often did not commit themselves to print, preferring instead the more immediate audience of tavern, coffee-house, and pit. Their story is told, however, by poet and dramatist who seldom miss an opportunity in prologue and epilogue, preface, and introduction to complain of the ill-nature of the men who, with a few precepts of Rapin and Dacier committed to memory, had set themselves up as judges in the literary world.

The reign of the small critic was supreme throughout

the Restoration, but in 1693 with the publication of Thomas Rymer's celebrated critique of Othello, the seeds of disintegration were sown. Rymer was immediately attacked by men who wrote, not with the authority of critical dogma behind them, but from a clear conviction that a system which reduced the greatest of English poets to "bloody farce" must somehow be in error. Out of the discussion that followed, arose the healthy criticism of the Age of Queen Anne.

During the era when the Tatler and the Spectator flourished, the concept of the critic underwent a change. The Earl of Shaftesbury wrote a spirited defense of the critic who responsibly undertakes his role; and Addison declared that the critic must be a person capable of poetic as well as critical performance, and that he must concern himself primarily with the positive aspects of a work of art, rather than exclusively with the faults. The critic must bring a mind capable of independent thought and judgment to bear on his decisions.

It was perhaps because of the over-development of the ill-nature of the critic in the Restoration that he was able to force himself from an amorphous position into one on a level with that of poet and dramatist. This high position, once achieved, he has never relinquished, though the reaction to his tyranny in the eighteenth century amplified the concept of the responsible critic.

The age of the small critic and his tyrannical system, as well as the reductio ad absurdum of that system in Thomas Rymer, was necessary to set in motion a reaction toward finer things. The wide and profitable discussion in the Augustan age of the function of criticism would hardly have come so early without the antecedent reign of the little Hectors with their ill-natured concern for only what an author has failed to do, rather than with what he has actually accomplished.

Microfilm $3.10; Xerox $10.60. 240 pages.

WILLIAM HAZLITT'S PHILOSOPHY OF THE MIND.

(L. C. Card No. Mic 59-4072)

John William Kinnaird, Ph.D.
Columbia University, 1959

This study is a critical analysis of Hazlitt's philosophical thought in its development up to the year 1812 -- the year when he ceased to write and lecture as a "metaphysician" and began his career as a London journalist and man of letters. My purpose is to demonstrate that the criticism of his later years proceeds from a vision of human nature that while not formally systematic is analytically consistent, and is therefore worthy of the name "philosophy."

The study is divided into two parts. Part One traces the evolution of Hazlitt's thought from his early adolescence to his conversion in 1798 to the "imaginative creed" of Coleridge and Wordsworth. Part Two is an exposition of Hazlitt's theory as modified in the years after 1798, showing the development of his ideas from their first published formulation (1805) to their mature expression in the lectures of 1812.

The first two chapters establish the meaning of the faith in "truth" and "principle" that Hazlitt inherited from Presbyterianism and from his father's Unitarian theology. Hazlitt's revolt against his father's tutelage is related to the secularization of the Millenarian ideas of "Rational Dissent," especially as manifested in Godwinism; and the influence of Godwin is further analyzed in terms of the need that arose after the failure of the Revolution for a redifinition of the individual. Hazlitt's "discovery" of "natural disinterestedness" -- his refutation of the doctrine of necessary selfishness -- is then examined as a reaction against mechanistic views of nature and the self-regarding prudential morality of the Calvinist tradition. Chapter Three concludes with a reconstruction of Hazlitt's "first acquaintance with poets," which I interpret as giving him confirmation of his belief in the primacy of imagination in consciousness.

Part Two first considers the ways in which Hazlitt's experience as a painter encouraged him to conceive of imagination, no longer as an intermediary "faculty" in the mind, but as a unifying power of "abstraction" (of qualitative generalization through feeling) in sense-perception itself. His theory of knowledge, however, while affording an apt critique of both sensationalist-empiricist and Kantian epistemology, is found to be indefinite in its account of the nature of relations in the mind, since he is content to rest his philosophy of dualistic realism on the "unaccountable" postulate of an original "sympathy" of consciousness with "the spirit of life and motion." His concept of "sympathy" is then explored in its ethical implications. Here, in the course of his refutations of hedonism and positivism, Hazlitt's idea of the sympathetic imagination emerges far more cogently, especially from his persuasive argument that not only the "moral sense" but all self-consciousness in time remains inconceivable without a real "communication" between mind and universal nature.

Part Two ends with a consideration of Hazlitt's struggle to account for evil by predicating a radical "love of power" in human nature without sacrificing his faith in a moral self-transcendence. His ideas of an unconscious mind are shown to be ultimately different from Coleridge's, since Hazlitt came to conceive of the mind's unconscious symbol-making power, not as generically self-originating, but as determined primarily by the "original character" of the self and by the individual mind's "reaction" upon its own experience. Yet notwithstanding his later insistence on the "exclusive" tendencies of imagination, there is no descriptive inconsistency in Hazlitt's theory: all meanings of "imagination" in his writing cohere in that they signify continuous (if often morally conflicting) modes of the intensive reaction of the mind in its individual wholeness upon any partial function of consciousness (sensation, reason, volition). So, too, his faith in "the human heart" is found to be finally consistent; for the "everlasting contradiction" of motives that produces human conflict generates also a transcendent sympathy of passion with passion -- an "ideal" sympathy that Hazlitt sees as giving the mind, in life as in art, a measure of moral and spiritual freedom.

An epilogue suggests that the transformation of Hazlitt the "metaphysician" into the brilliant personal stylist of the Regency was in many respects a destiny implicit in his philosophy.

Microfilm $4.90; Xerox $16.40. 381 pages.

EXISTENTIALISM AND THE MODERN AMERICAN NOVEL.

(L. C. Card No. Mic 59-3204)

Richard Daniel Lehan, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Frederick J. Hoffman

This study examines the affinity between the French existential novelists Jean-Paul Sartre and Albert Camus and the American novelists Ernest Hemingway, William Faulkner, and John Dos Passos. It also examines the effect that Sartre and Camus have had in turn on such recent American novelists as Paul Bowles, Saul Bellow, Richard Wright, and Ralph Ellison.

The first chapter states the problem and treats historical background. The second treats the literary characteristics of existentialism. The third compares Camus and Hemingway. The fourth considers the popularity of Faulkner among the existentialists. The fifth treats the influence of John Dos Passos' U.S.A. on Sartre's The Roads to Freedom. The sixth chapter describes the influence that Sartre and Camus have had on the "new" American novel.

An examination of a number of existential novels reveals recurrent patterns. The existential hero is continually pitted against an elemental universe and ultimately accepts suffering as a way of life. The meaning of his life is in a struggle against an ineffable and "absurd" affliction. The protagonist is usually alienated from society. He leads a lonely life, characterized by internal conflict, often a solipsistic dilemma, and exercises his instinct and emotion at the expense of conscience and reason. The existential journey is both tragic and romantic; the protagonist pursues an unattainable physical and social ideal to the point of disillusionment, If not of actual self-destruction. The existential scene is virtually an antagonist and is often portrayed as a kind of prison. The existential novelist abandons the omniscient point of view in order to establish a direct relationship between the reader and the hero. The early Camus reveals the hero immersed in the present moment. Sartre is careful to reveal the futurity of time and the possibility of free will.

Camus was interested in the way Hemingway portrayed the innocent mind confronted with a world it had to endure but could not understand. He adapted the Hemingway style in The Stranger because it established a one-to-one relationship between the narrator and the absurd world that contained him. The existentialists admired Faulkner because he had depicted an "absurd" void between an action and the narrator's ability to verbalize the meaning of that action; created an irrational world, latent with violence, ruled by a cruel Player or Joker; portrayed the loss of innocence and the suffering that is part of man's tragic destiny; and extolled the man who was able to accept his fate with quiet heroism. Sartre was interested in Dos Passos who had created a novel of situation and built a literary structure that identified the reader with the action in such a way that the reader was forced to play the part of the chorus and pass judgment on both the characters and himself. Many "new" American novelists are concerned with existential problems of identity, the nature of good and evil, the possibility of fulfillment in society, and the possibility and meaning of solipsistic action. In their fiction the alienated hero cannot formulate a way of life to replace the social existence he abandons. The anti-hero is continually on the edge of a madness that leads to self-destruction.

Existentialism is a product of the modern world. In many ways an enlarged naturalism, the philosophy championed the reaction against traditional and social values. Still partially under the influence of naturalism, the American novelist was also rebelling against his society. This situation perhaps accounts for the continued affinity between French existentialism and the American novel.

Microfilm $3.90; Xerox $13.20. 303 pages.

ITALIAN AND SPANISH INFLUENCES AND PARALLELS IN THE LIFE AND WORKS OF SAINT-AMANT, 1594-1661.

(L. C. Card No. Mic 59-3898)

Richard A. Mazzara, Ph.D.
University of Kansas, 1959

This study attempts to develop more fully than has heretofore been done Saint-Amant's most significant allusions to Don Quijote. It indicates as well the possible influence of other Spanish works and authors (Lazarillo, Quevedo, Guzmán de Alfarache, Juan Huarte, Duke de Osuna) on those pieces by Saint-Amant that exhibit particularly the "dual personality" of Renaissance and Baroque culture. Of the influences of Spanish prose on Saint-Amant's poetry, that of the picaresque novel is of especial significance. Tracing the "heroic" and the "anti-heroic" in Saint-Amant's life and works illustrates how the bourgeois poet participates in the extreme tendencies of his day.

Saint-Amant's Solitude owes nothing to Théophile de de Viau's "Solitude." Théophile's piece is mostly mariniste in inspiration, and while Saint-Amant is often influences by Marino, in the Solitude the kinship to the Spanish soledad is much more significant. Saint-Amant feels no keen disappointment and is therefore far more detached before nature than is the typical Spanish seeker of solitude; but also, he has seen more in nature and been more truly alone than Théophile. The same may be said of Saint-Amant in his second "solitude," "Le Contemplateur." His attitude before nature is much like Góngora's (and Théophile's in his "Elegie à une dame"), then, and there is similarity in the general plan of his poems and Góngora's Soledades; more important, there is the same poetic conception of nature, which is one of subjective naturalism rather than a purely elegiac or a falsely sentimental one.

Despite his protestations to the contrary, Saint-Amant knows and utilizes materials from Ovid's Metamorphoses. Although there are parallels in Cervantes (Don Quijote, I, XII-XIV) and in two fables by Villamediana, the most immediate sources of Saint-Amant's "Métamorphose de Lyrian et de Sylvie" are the "Dafni" and "Siringa" of Marino's Sampogna. Comparisons of Lope de Vega's and Saint-Amant's with Ovid's version of "Andromeda" show that Lope's piece is an important source of "L'Andromède." Lope's influence as a dramatist is at least indirectly as significant as his influence as a poet. Both modern poems give evidence of Marinism. Saint-Amant's "Palais de la

Volupté" shows the influence of Marino's Adone and Villamediana's "Fábula de Faetón" in the importance given to Baroque settings for the full development of voluptuous and intellectual pleasures. "La Nuict" and "La Jouyssance" are influenced chiefly by Marino's "Amori notturni," "Trastulli estivi" and other pastoral and erotic poetry inspired in part by Ovid. However, Saint-Amant's "jouyssance" is to be shared completely with the woman he loves, foreshadows the best précieux tradition, and is not unrelated to the tradition of which Calisto and Melibea are a part.

Le Passage de Gibraltar clearly shows the general influence of Tassoni's Secchia Rapita in that Saint-Amant selects a single historic action as the subject of his poem and proceeds to analyze and document it, clearly distinguishing between its heroic and comic elements. In Tassonian fashion, Saint-Amant applies the conventions of epic poetry to his material; but he does not impose the classical "rules" uniformly as does Tassoni, who thereby converts his essentially non-heroic into a pseudo-epic, and therefore ridiculous, subject. Saint-Amant obviously does not have the deadly satirical purposes of Tassoni. The same spirit of fun is found in other burlesque or mock-heroic pieces by Saint-Amant in which the heroic is mixed with the comic to produce marvelous effects, chiefly by means of language over which the poet must have complete mastery.

Much of Saint-Amant's poetry treated under the heading of the satyrique, rather than burlesque, is inspired by Berni and Italian imitators of his. Berni's "Capitolo del Prete da Povigliano" is an important source of Saint-Amant's "Chambre du debauché," "Mauvais logement" and parts of his Rome ridicule. The same piece by Berni influenced Caporali's "Pedante," which in turn is a source of Saint-Amant's "Poëte crotté." Berni's "In lode d'Aristotile" and "Le bellezze della sua donna" are reflected also in Saint-Amant's poem. His "In lode delle pesche" inspired many Bernesque poets, e.g., Lasca, who wrote two pieces in praise of melons which were imitated by Saint-Amant in "Le melon" and in other caprices of the same type. Saint-Amant's long career in the Bernesque belies his criticism of Berni in favor of Tassoni.

Microfilm $2.60; Xerox $9.00. 200 pages.

THE HUMANISM OF ROBERT FROST: A STUDY IN PARALLELS.

(L. C. Card No. Mic 59-3952)

Thornton Harris Parsons, Ph.D.
University of Michigan, 1959

This study tests the hypothesis that Robert Frost is an exemplar of the traditional humanism that borrows ideas from both religion and naturalistic philosophy, and yet is independent of each. The justifications for examining the poetry of Frost for his convictions about how to live are two: he is hortatory in many poems, and he has made the forthright declaration that a poem should end in wisdom. These are implicit invitations to the reader and critic to consider his philosophical position.

Chapter I is an essay at definition of the traditional humanism that calls for a mediation between spirituality and materialism. Its affinity with religion is in the prescription of ethical standards by which to develop the best self: the power in man that relates him to permanence. Its affinity with naturalism is in the prescription for exercising the phenomenal self; the power in man that relates him to change. This independent humanism is differentiated from other varieties of twentieth-century thought that use the name 'humanism.'

Chapter II presents with documentation and explanation, five important emphases of modern humanism, four from Babbitt and one from Thoreau. The four emphases from Babbitt are predominantly ethical. Babbitt admits theoretically the affinity of humanism with naturalism, but in his earnest practice as the critic of a declining civilization, he is uneasy with empathic response to Nature, for it may lead to revery. We must go to Thoreau for an emphatic assertion of faith in the chastened sensibility--the sensibility that will uncorruptedly register the sounds, sights, and feelings of the environment, and not some preconceived idea of them. Thoreau esteems the wild no less than the good. He is free from Babbitt's uneasiness.

Chapter III is a discussion of Frost's poetry in parallels with the five lines of modern humanism laid down in Chapter II. Many passages from Frost's poems are quoted and analyzed to demonstrate his recurrent interest in themes that may properly be called humanistic, to demonstrate his central conviction that human life is different from natural life--but not divine, not superhuman--and to demonstrate his belief in the rightness for man of a positive joy, his advocacy of a harmony between ethics and sensibility.

Chapter IV extends into art the contrast between the attitudes of Babbitt and Frost toward sensibility. Nature and art are the two realms where the phenomenal self may be exercised. Babbitt's fear that the individual can be corrupted through the idyllic imagination makes him uneasy with art as well as with Nature, and he habitually passes over aesthetic excellences in his zeal to praise or denounce a work's ethical teaching. But Frost has a catholic aesthetic, the best protection against parochialism. He values the joy in empathy and in sensuous qualities; and he strives for comprehensiveness, a wide view of alternatives.

My conclusion is that Frost exemplifies the spirit of an independent humanism, the spirit that Babbitt understands, I believe, but mars by a self-conscious struggle against twentieth-century naturalism. Babbitt is habitually preoccupied with his duty to fight the ideas and practices that are undermining Western Civilization. In Frost, though, the full consciousness is balanced with, not submerged by, the strict conscience. American humanism in the twentieth century has been too narrowly viewed as a polemical struggle. The pugnacious and interested doctrinal humanism of Babbitt needs the corrective of Frost's poetic humanism, ethical yet comprehensive, responsible yet lyrical. Microfilm $2.20; Xerox $7.80. 167 pages.

THE SOLITARY CLARINETIST: A CRITICAL BIOGRAPHY OF ABRAHAM CAHAN, 1860-1917.

(L. C. Card No. Mic 59-4084)

Theodore Marvin Pollock, Ph.D.
Columbia University, 1959

Born on July 7, 1860, in Podberezie, Russia, Abraham Cahan grew up amidst the rich cultural heritage of Vilna. While receiving a traditional Jewish education, he studied Russian secretly and--through friends--was introduced to Socialism. Upon graduation from the Vilna Teachers' Institute, he was assigned to teach in Velizh. With the assassination of Czar Zlexander II, government repressive measures were intensified and, because of his known friendship with several radicals, Cahan was marked for investigation. He fled Russia and joined an idealistic group whose intention it was to found communist colonies in America.

He landed at Philadelphia on June 6, 1882, abandoned the idea of colonies, and settled in New York. Learning English quickly, he supported himself by teaching. He flirted with anarchism, but joined the Socialist Labor Party. In 1885, he married Anyuta Braunstein and began to write articles on Jewish life in America for the New York Sun, Star, and Press.

In 1890, he helped found the Arbeter-tsaytung, a Yiddish-language Socialist newspaper, for which he wrote articles popularizing science, literature, and Socialism, assuming its editorship in 1891. Later that year, he also helped found--and began writing for--Di tsukunft, a magazine of similar content. By this time, he was a well-known Socialist lecturer. In 1894, he was elected editor of Di tsukunft. Meanwhile, the Socialist Labor Party was falling into the hands of Daniel De Leon, whose dictatorial policies alienated many Socialists. By 1897, a group had separated itself from De Leon and founded the Forverts with Cahan as editor. Dissension over editorial policy ended with his resignation four months later and he turned to English. His realistic short stories had come to the attention of William Dean Howells, who helped him publish his first novel, Yekl, in 1896. With something of a literary reputation, Cahan went to work for the New York Commercial Advertiser, under the editorship of Lincoln Steffens. During his five years with the paper, he also published stories in several leading magazines and in 1898 D. Appleton and Co. brought out his The Imported Bridegroom and Other Stories.

The Forverts, whose circulation had stagnated at 6000, invited him to return in 1902, He accepted and, using the journalistic techniques learned on the Commercial Advertiser, turned the highly abstruse newspaper into a vivid, human-interest filled daily. Circulation increased almost immediately. In 1905, his novel of revolutionary Russia, The White Terror and the Red, was received cordially by the critics. At the beginning of World War I, he sided with Germany as the fountainhead of Socialism and foe of Czarist Russia. With the February Revolution of 1917, however, Cahan supported the Allies. The war's end saw the publication of The Rise of David Levinsky, the novel justifiably considered his most important literary perfromance.

There were, in reality, four Abraham Cahans. As American author, he is a minor but interesting figure--a pioneer realist who wrote our best Jewish-American novel. As Yiddish editor and journalist, he introduced to Yiddish journalism the sure-fire--if not always creditable--circulation building techniques of American journalism. A natural outcome of his dual role as American author and Yiddist journalist was his contribution to understanding between the two worlds he straddled, explaining the Jewish immigrant to his American audience and Americanizing his Jewish audience. As a Socialist, he helped shape the Socialist Party in America through founding, with others, the Social Democratic Party and his repeated support of Eugene Debs. To the extent that many Socialist principles were eventually adopted by the major American political parties, Abraham Cahan's legacy forms a portion of the climate of our own time.

Microfilm $5.55; Xerox $19.40. 433 pages.

THE TRIUMPH OF EARTH: A STUDY OF THE POETRY OF EDWARD THOMAS.

(L. C. Card No. Mic 59-3650)

John Curtis Richardson, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Robert H. Sproat

The subject of this dissertation is the poetry of Edward Thomas, writer of country books, of literary criticism, and briefly, from 1914 to 1917, of poetry. This last, his finest writing, has not received full, scholarly study even though since his death Thomas has become increasingly regarded as a poet of importance. The aim of this paper, therefore, is to relate Thomas to his poetic milieu and to provide a full descriptive, interpretive, and critical study of his poetry in order to define its significance and importance.

A study of his relations with his poetic milieu reveals that although Thomas sensed the underlying tendencies in the poetry of the period, he kept himself aloof from contemporary poetic movements. He was personally acquainted with many of the poets of the period, Traditionalists, Georgians, and Imagists; he reviewed the work of Yeats, Pound, and Frost; he knew that the chief creative tendency in the verse of the period was away from aestheticism and other symptoms of the fin de siècle toward poetic realism-- toward functional rhythm and imagery and the diction of speech--a return of poetry to life. But because of his natural reserve, his respect for many kinds of English poetry of the past, his love of the country and country writing, his development already in his prose of his own style, and his friendship with Frost--because of these factors, he maintained his independence from contemporary movements such as Georgianism and Imagism to write his own original poetry.

A study of his style reveals that Thomas participated in the creative poetic revolution which occurred during his time. He participated in the removal of the late Victorian poetic facade: his poems reveal a new simplicity of organic rhythm, music, and imagery. He participated in the construction of at least the foundations of the twentieth-century manner: his poems reveal the modern fusion of realism and symbolism and the modern exploitation of the ambiguities of poetic language.

A study of the content of his poems reveals two major

motifs: isolation and nature. Most of his poems reveal by their themes, their dramatic situations, and their imagery the experiences of a man alienated by society and its thought-patterns, isolated from his acquaintances, his family, his own past, and even himself. At the same time most of them reveal that he sought for ties to rid himself of the feeling of being isolated. His search for Beauty he recognized to be a failure, a sterile reversion to the mood of the fin de siècle. His other tie, his life-long attachment to nature, finds its best expression in many of his poems. These reveal that at times he is able simply to enjoy nature as a field-naturalist. Occasionally and unsuccessfully he tries to find spiritual consolation in nature. Often, and this is one of Thomas's remarkable achievements, he reconciles himself to nature's indifference, because he finds that it is good for man to know that "earth is something more than a human estate": it provides man with the perspective, the sanity, and the humility that he needs in order to live the good life.

A study of his poetry reveals that Edward Thomas should be considered one of the important minor poets of the twentieth century. Writing within the confines of a narrow range of ideas and an unassuming rhetoric, he wrote a large number of true poems, poetic re-enactments of the significant experience of exile and search. These poems express important aspects of the modern consciousness in the modern poetic manner. His vision of man's place in his earth-home may be compared with D. H. Lawrence's and Robinson Jeffers'. His is less exciting and less passionate, more calm and more sane.

Microfilm $3.85; Xerox $13.00. 299 pages.

A STUDY IN THE EARLY LIVES OF MILTON.

(L. C. Card No. Mic 59-4087)

Edward Lehman Ruhe, Ph.D.
Columbia University, 1959

The five Early Lives of Milton (1681-1698) constitute a significant focus of interest for studies in Milton biography and in the early Milton tradition. Milton's writings had considerable importance in the controversies of the 1680's and 1690's, and Milton himself evidently enjoyed status as a hero figure of sorts to the Whigs and a villain to the Tories. The political milieu which produced the Early Lives can accordingly help explain the origins and character of these early and largely primitive essays in biography. At the same time, examination of the early traditions of life-writing, of the characters and motives of Milton's biographers, and of the extensive web of relationships which existed between these early essays, sheds light on problems of historical evidence vital to Milton scholars. These and other modes of analysis can yield revealing results when applied to the Early Lives.

A close inspection of John Aubrey's Milton Minutes in the Brief Lives manuscript, for example, suggests that Aubrey was for the most part a reporter of first-hand testimonies, the bulk of them collected from three and perhaps only three major informants: Milton's widow, brother, and nephew. Aubrey evidently had very little biographical material of his own to contribute. The limitations of the informants, plus Aubrey's policy of avoiding material from printed sources, produces a strong emphasis on the private, non-political side of Milton. There is reason to date the bulk of the notes no earlier than the summer of 1681, and no later than 1682; and close study of the manuscript permits us to reconstruct several of the stages of Aubrey's note-taking, so that a conjectural chronology for many of the Minutes can be worked out.

The Anonymous Life, which Anthony Wood used as his principal source, was evidently conceived as a prefatory biography. Its image of Milton is limited and in some ways unconvincing, although it deserves its reputation for factual reliability. The unknown writer, who may or may not have known Milton as a close friend, wrote in the spirit of eulogy, being above all concerned to present Milton as a model of virtue. His account is accordingly weak in the particulars of Milton's private life.

Anthony Wood's article on Milton in the Athenae Oxonienses, 1691, is all but worthless as a biographical source. He borrowed heavily from the Aubrey and Anonymous manuscripts, contributing practically nothing from his own knowledge and researches except a thirty-four-title bibliography of Milton's writings. At the same time, close analysis of his essay in the context of Tory polemics of the 1680's and 1690's raises serious questions about the traditional role of Wood as one of the great detractors of Milton. Considered as a Tory attack, Wood's essay is a failure. Its hostility toward Milton is impersonal and quite limited in expression; and it borrows from its sources pro-Miltonic material bearing upon nearly all the controversial passages in Milton's life. In short, the tradition of Wood's violent antipathy for Milton calls for thoughtful reexamination.

Edward Phillips wrote his "Life of Mr. John Milton" (1694) as an aggrieved nephew of a distinguished and much slandered man. It seems clear that he aimed to supply a vindication and a public rehabilitation of John Milton as a national hero whose association with the Commonwealth could be partly excused as an act of misguided patriotism. His major tactic -- this essay is a fascinating fabric of persuasive devices -- was to gloss the regicide issue and to supply a dramatically effective account of the Salmasian controversy. Phillips shows a remarkable confusion of feelings toward his uncle, however; and his unreliability as a reporter of facts may well be a critically important danger in Milton biographical studies.

John Toland's Life (1698) is an excellent early example of a biography intelligently compiled from a large number of the best sources, including nearly all of Milton's writings, plus important manuscript materials, and testimonies of such survivors as Deborah and Elizabeth Milton, the nephew John Phillips, and an unidentified amanuensis. It borrows its polemic tone in very large part from Toland's extensive and enthusiastic treatment, including abundant direct quotation, of Milton's controversial writings. Controversies which followed its publication perhaps go far to explain why Milton biography came to a virtual standstill between 1698 and 1725, when Elijah Fenton's prefatory biography made its first appearance.

Microfilm $2.90; Xerox $10.00. 222 pages.

HENRY GREEN, A CRITICAL STUDY.

(L. C. Card No. Mic 59-3598)

John David Russell, Ph.D.
Rutgers University, 1959

Major Professor: Dr. Horace E. Hamilton

This study of Henry Green's novels attempts to elucidate the author's themes, primarily through an analysis of structure and imagery. It is felt that Green's fidelity to artistic criteria justifies an approach to the meanings of his books that gives first consideration to his experimental techniques.

The introductory chapter considers Green as belonging in the tradition of early twentieth century novelists, like Mann and Joyce, whose criteria were mainly aesthetic. Yet, at the same time that Green is acknowledged as a symbolist novelist, he is estimated to be a comic writer, having affinities with writers like Swift, Sterne, Carroll, Butler, and Celine, although his resemblances to these figures are concealed by his addiction to form.

The two-fold problem that then presents itself to the critic is that of evaluating the rigid aesthetic procedures that govern Green's approach to fiction, in their relation to the humor that compensates for formal strictures. This relationship is the chief concern of the second chapter, devoted to Green's theory, technique, and style. His reliance on dialogue is here discussed, and the conclusion reached that Green communicates with readers in two related ways: the context containing the symbol, and the humor attending dialogue, have the function of concealing or rendering ambiguous the themes that he hopes different readers will extricate differently. Green courts confusion deliberately because he focuses on his characters' inability to understand themselves, others, and their predicaments. He looks non-committally on such failures to understand; the preoccupations that breed them obstruct self-knowledge, but are often necessary for a character's protection or salvation.

Green's novels can be differentiated according to his principle that "except in disaster, life is oblique in its impact upon people." The statement marks a difference between Blindness (1926), Caught (1943), and Back (1946), and the novels having the suffix -ing in their titles. In the -ing novels, which deal with "everyday mishaps," much is threatened, with the characters' predicaments continuing unresolved, while in the first-named group, all is lost (i.e., eyesight, a wife, a leg are lost), whereby ensuing catharsis contributes to the novels' resolutions. Those -ing novels having inane titles and situations--Party Going (1939), Nothing (1950), and Doting (1952)--can be distinguished from Living (1929), Loving (1945), and Concluding (1948), Green's most representative novels, which combine the comic treatment with situations not disastrous but moderately serious.

Loving is discussed before Caught, but otherwise these novels have been examined chronologically. This is important because Green's themes reflect his progress from qualified optimism to pessimism, as he seems to become increasingly aware of his principals' emotional needs. The pivotal book is Concluding. In all the novels that preceded it, except Caught, Green's males, self-conscious and needing sustenance, were buoyed up by women of domestic fervor, instinctively committed to the flux. But in the impending war of Caught, women became modified, were a divisive force, and the theme of the novel involved their being repudiated. Concluding presents women similarly modified--this time because their organizing drives have been given free play in a futuristic state--and Green's once serene view of the natural continuum changes to a fearful outlook. In the next novels, Nothing and Doting, neither resuscitative nature nor sympathetic, resourceful women appear.

The study concludes with an estimate of Green's non-Promethean view of man, which precludes his embracing modern fictional themes that favor individualistic revolt, and which finds him favoring familistic bonds, which allow for most extension of mutual support--a dismal view, balanced by his cheery conviction that men's preoccupations and self-magnifying tendencies make their world a more enchanting place than it really is.

Microfilm $4.55; Xerox $15.20. 353 pages.

A CRITICAL STUDY OF THE NOVELS OF THEODORE DREISER.

(L. C. Card No. Mic 59-4036)

Charles Katz Shapiro, Ph.D.
Indiana University, 1959

Theodore Dreiser's novels have often been dismissed as inartistic, sociological documents. Yet the very critics who speak about Dreiser's roughness of style will readily admit the powerful emotive effect of his work.

A careful study of all of Dreiser's novels shows that though he was an uneven writer, Dreiser was conscious of his craftsmanship, and his lengthy fictional works were carefully planned and carefully written. They were part of his lifelong inquiry -- his continual grabbing at what he considered to be the vital problems inherent in American life.

Dreiser's novels all have an important design, significant because he was a keen, if often naïve observer of the social and political realities of his day. He saw America as being at middle age, and he was concerned about a culture which was both destroying its own worthwhile institutions and robbing the individual of his chance to live up to a full, meaningful potential. Each of Dreiser's novels illustrates a different aspect of what he felt was a crucial misdirection of American energy.

Sister Carrie, his first novel, concerns itself with a close study of the individual. Dreiser takes several protagonists from varied economic strata of American life and shows how they are harmed and corrupted by the fraudulant claims of a spurious American dream. All the characters, the symbols, the action, and even the details are attuned to a basic theme, an elaboration of Emerson's complaint that "things" dominate the American scene. The theme is specifically the effect, on the individual consciousness, of the misdirection of the American success dream; and Dreiser has captured, in the story of Hurstwood and his decline, an almost ideal man and situation to epitomize the essence of early 20th century America. Hurstwood's fall is an ironic contrast to Carrie's growing success, though both are in essence engaging in the same pointless struggle.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

In Sister Carrie the theme is the effect, on the individual consciousness, of the misdirection of the American success dream, and eleven years later Dreiser explored in his second novel, Jennie Gerhardt, the effects of American materialism on the American Family. Two family groups are presented at opposite social and economic poles, and we see them both as separate entities in their own private worlds and as they are in clash with each other. Both families fail to function as cohesive, loving units.

In Dreiser's trilogy (The Financier, The Titan, and The Stoic) he concentrates on the career of a successful businessman; he presents the story of Frank Cowperwood who is both ruthless and human.

In The "Genius" Dreiser tries to portray and understand the American artist. His basic theme this time is the study of the forces harmful to the creative mind; unfortunately, by placing the blame on a curious mixture of capitalism and eroticism, his novel rests on a faulty base.

The Bulwark is Dreiser's most unusual noval; yet it too can be seen in terms of an underlying action. Religion, often hailed as the answer to our materialistic ambitions, is shown as failing. Dreiser plots his novel around a good, believing Quaker, and shows what happens when moral scruples collide with American reality. Solon Barnes' struggle becomes tragic as we realize he is fighting an almost impossible battle.

An American Tragedy is Dreiser's most important book, for it incorporates all the themes underlying his other novels. The theme is more ambitious: Dreiser does not concentrate on religion, or the artist, or the family, or the tycoon. The story of Clyde Griffiths becomes the story of all America; and as in all of Dreiser's best works, he handles his material with honesty, care, and artistry. Microfilm $2.45; Xerox $8.60. 188 pages.

AUGUSTO THOMSON D'HALMAR, FANTASIST.

(L. C. Card No. Mic 59-4038)

George Ernest Smith, Ph.D.
Indiana University, 1959

Generation of 1900

The body of writers known as the Generation of 1900, in Chile, supplied a new set of values for the literature of that country, for these men reacted against the decadence in literary work toward the end of the nineteenth century. In general, the reaction resulted in a lively interest in national themes; in particular, it was an interest in the campo and its people.

Among the writers of this generation, however, there were some who sought inspiration in sources other than the native land. These men looked within their own minds and those of their countrymen to study the idiosyncrasy of their social group. They sought the answers to questions within the individual, and they refused to be constricted by terrestial or geographic bounds.

Perhaps the most important young writer to follow this inclination was Augusto Thomson, later known as d'Halmar, one of the most representative figures of his generation. D'Halmar, who had considerable influence on such writers as Fernando Santiván, Rafael Maluenda, Salvador Reyes, Januario Espinosa, and Luis E. Délano, became undisputed chief of a school or doctrine of Imaginismo. Indeed, d'Halmar was an astonishing literary personality when considered from the standpoint of bi-directional influences. His mind was a storehouse of foreign ideas and trends which he helped to disseminate in Chile. His most important contribution to literature, however, was the introduction of the elements of poetry and fantasy into Chilean prose.

Life and Works

D'Halmar was born in Santiago, Chile on April 23, 1882. Soon after, his family moved to Valparaiso where, in the picturesque port district, Augusto first came into contact with the sea that he was to grow to love so much.

He was a very precocious child and showed early signs of his interests in literature and the theater. Augusto, raised by his grandmother, had little formal schooling; however, by the time he was eighteen years old, he was established as a journalist, a fairly regular contributor to Los Lunes, Luz y Sombra and La Lira Chilena. In 1900, the young writer became director of Instantáneas, where he also conducted several feature columns.

D'Halmar's first novel, Juana Lucero, published in 1902, was by no means indicative of the type of writing for which he later became known; but it helped enormously to bring his works to the attention of the reading public in Chile. In addition, his fame grew through his ability as an orator at the Ateneo and through his organization, along with Santivan, of the experimental Tolstoy Colony, an attempt to utilize the social-religious precepts of Tolstoy in the formation of a colony composed of artists.

The imaginista phase of d'Halmar's writings was initiated with the work entitled La lámpara en el molino. His addiction to fantasy and the supernatural became much stronger during the two decades following the writing of this book, probably as the result, in part, of travel and residence in India and various parts of the Far East. Among the most representative books demonstrating d'Halmar's use of fantasy are Los alucinados, La sombra del humo en el espejo, Mar, Capitanes sin barco, and Nirvana. The spirit of the fantastic and the imaginative is found in almost all of d'Halmar's work, whether it be prose poetry, short stories, novels, or travel literature.

This man, who was pleased to be called "Almirante del Buque Fantasma," died in Santiago on January 27, 1950.

Microfilm $3.35; Xerox $11.40. 258 pages.

THE HISTOIRES TRAGIQUES OF FRANÇOIS DE BELLEFOREST, A GENERAL CRITIQUE, WITH SPECIAL ATTENTION TO THE NON-BANDELLO GROUP.

(L. C. Card No. Mic 59-4246)

Arthur Phillips Stabler, Ph.D.
University of Virginia, 1959

The first part of the dissertation sums up, as introduction and background, the known information on the life of Belleforest and on his literary output in general. Specially studied is contemporary and subsequent literary criticism of his work.

The second part specifically analyzes the Histoires

tragiques from a number of points of view. First, the work is situated in its social and literary milieu. It is shown that a recognizable genre of histoires tragiques, a branch of the nouvelle sentimentale as defined by Gustave Reynier in his Roman sentimental avant l'Astrée (Paris, 1908), existed in the second half of the sixteenth and first half of the seventeenth centuries in France, and that Belleforest has a right to be regarded as the chef d'école of this genre. Along with the Amadis romances, the Histoires tragiques fulfilled the important function of a manual of manners, the art de bien dire both oral and written of the cultured society of the period, a society which was already essentially the salon society which, at first précieux, was later to make possible French Classicism.

The remaining chapters of the second part deal with specific literary features of the work, particularly as they illustrate important features of French prose fiction of the sixteenth century and its cultural milieu. Primary among the distinguishing features of the Histoires tragiques is the use of moralizing and of psychological analysis. The moralizing, which permeates the work ad nauseam, may be regarded to some extent as reaction from the political and social instability and the license of the period of the Wars of Religion. The psychological analysis, a prime feature of the sentimental genre, represents a peculiarly French intellectual and literary preoccupation, transforming the literary raw materials often borrowed from abroad. Closely related to the two preoccupations just mentioned is the consideration of the style and technique of the Histoires tragiques. Belleforest shares the disorder, the lack of measure and balance characteristic of most sixteenth century French prose, long moralizing or historical digressions being his worst stylistic sins. Occasionally also examples of the figured style of the précieux writers are to be found.

The Histoires tragiques had considerable influence in England, as is ably demonstrated in René Pruvost's Matteo Bandello and Elizabethan Fiction (Paris, 1937). While the Histoires tragiques may profitably be studied in connection with the sources of Elizabethan fiction and drama, It is in the features of style and technique that the greatest connection is seen. According to Pruvost, English translators and adapters of the work only continued further along the same road taken by Belleforest in the matters of rhetoric and digression, as well as in the preoccupation with moralizing and analysis. Concluding the second part is a chapter on the bibliography of the Histoires tragiques, in which an effort has been made to collect the known information on this complex topic, and to elucidate further certain of the problems involved.

Part three of the dissertation consists of detailed analyses of a selected group of the non-Bandello Histoires tragiques; that is to say, those histoires not adapted from the Novelle of Matteo Bandello (the stories from Bandello are analyzed in René Sturel's Bandello en France au XVIe siècle [Bordeaux, 1918], to which the present study is greatly indebted). In each case, a rather complete summary of the story, identification of the immediate sources where possible, discussion of the fortunes, if any, and general remarks on features of special interest, are given. Treated more at length are Belleforest's version of Hamlet, generally recognized as a Shakespeare source, and his version of the story of Marguerite de Roberval, of interest in the early history of French colonization in Canada. It is intended eventually to expand this part of the study to include all of the non-Bandello Histoires tragiques. Microfilm $5.75; Xerox $20.00. 449 pages.

GEORGES CHENNEVIERE HIS LIFE AND WORKS.

(L. C. Card No. Mic 59-3229)

Ben Frank Stoltzfus, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Alfred Glauser

This study is a historical and critical analysis of Georges Chennevière's life and works (1884-1927): the early formative years, his friendship with the "copains" Jules Romains, Georges Duhamel, Charles Vildrac, Luc Durtain, René Arcos, and the influence of L'Abbaye de Créteil; his acquaintance with Maeterlinck and Georgette Leblanc, his marriage, and the fateful war years during which Chennevière was a soldier at the front; his role in the Fêtes du Peuple organization with Albert Doyen, his job as reporter for the newspaper L'Humanité; his contribution to L'Ecole du Vieux-Colombier and his relationship with Jacques Copeau.

I have traced the development of Chennevière's poetic talent from 1905--the date of the inception of unanimism, the poetic consciousness of group behaviour within the large modern city--to his premature death in 1927. Unanimism was a reaction against symbolism while at the same time continuing certain literary trends established by L'Ecole Romane, Le Naturisme, and L'Humanisme at the turn of the century. Chennevière's contribution owes much to Renan, Hugo, Goethe, Wagner, Flaubert, Poe, Baudelaire, Zola, Tolstoi, Verhaeren, Whitman, and Jules Romains, whom he resembles at times, yet with whom he differs profoundly. There was a parallelism of unanimism with the evolving sociological theories of Comte, Durkheim, Le Bon, and Tarde.

The dominant themes in Chennevière's poetry are time and death and a preoccupation with the ephemeral, love as a fraternal bond between men, the escape from a contingent world into the immortality of unanimism, and the perfectibility of his poetic art. The so-called "poésie immédiate", with its direct evocation of reality, is close to certain mid-century trends, while at the same time drawing inspiration from a strong vein of popular lyricism. Starting with a Whitmanesque and Claudelian exuberance, Chenneviere progresses towards a refinement in versification which uses technical innovations based on a series of "accords" (an inner rhythm of corresponding sounds) advocated by the Petit Traité de versification (published by Jules Romains and Chennevière in 1923). A poem like La Légende du Roi d'un Jour, a lieder cycle with music by Maurice Le Boucher, links Chennevière's poetry with the tradition of the "chanson populaire". Chennevière's ideas on esthetics and art were published in various newspapers and reviews.

Three appendices contain unpublished poems, manuscripts, and letters, while the bibliography lists all of Chennevière's works. The bibliography also has a list of all known references (articles and reviews) to Chennevière. Microfilm $5.70; Xerox $19.80. 445 pages.

POLYNOMIALS RELATED TO APPELL FUNCTIONS OF TWO VARIABLES.

(L. C. Card No. Mic 59-3911)

Phillip Edward Bedient, Ph.D.
University of Michigan, 1959

The thesis begins with a general discussion of the known generating functions for the Legendre polynomials, $P_n(x)$. By making use of a little known relation satisfied by the $P_n(x)$, the discussion naturally leads to a search for a function which generates the $P_n(x)$ in a new way. It is also shown that this same relation satisfied by the $P_n(x)$, when used in conjunction with the known generating functions for the $P_n(x)$, gives simple derivations for certain functions which generate products of known polynomials. These results had previously been obtained by Brafman and Weisner by the use of different methods. While the thesis does not succeed in finding the suggested generating function for the $P_n(x)$ as the sum of products of known functions of a single argument, it does give the function as a well-known function of two arguments. In 1926 Appell made a study of a simple class of hypergeometric functions of two variables, which he denoted by F_1, F_2, F_3, and F_4. The thesis shows that a certain Appell F_1 generates the $P_n(x)$ in the new way mentioned above. Since it was previously known that the $P_n(x)$ are also generated by an Appell F_4, it seemed natural to investigate the functions which are generated by Appell's F_2 and F_3. First of all, however, the previous results are generalized to show that the Gegenbauer polynomials, $C_n^{\beta}(x)$ are also generated by both an F_1 and an F_4.

In the second chapter a careful study is made of the functions generated by certain Appell F_2. These functions are called $R_n(\beta,\gamma;\ x)$ and are shown to be well-poised hypergeometric ${}_3F_2$'s. By applying a transformation due to Whipple these ${}_3F_2$'s may be written in powers of the variable x to obtain ${}_3F_2$ forms which demonstrate that each $R_n(\beta,\gamma;\ x)$ is a polynomial of degree n. From each of these ${}_3F_2$ forms a generating function is obtained for the $R_n(\beta,\gamma;\ x)$. The one generating function is a product of two hypergeometric ${}_1F_1$'s, and the other is the product of a binomial function and a ${}_2F_1$. By a technique due to Sister Celine, it is shown that the $R_n(\beta,\gamma;\ x)$ do not form an orthogonal set and that they satisfy a four-term recurrence relation. An adaptation of Sister Celine's technique first used by Shively is also used to obtain two differential recurrence relations. A further adaptation of the same technique is used to find several contiguous relations satisfied by the $R_n(\beta,\gamma;\ x)$. Standard techniques are used to obtain the third order linear differential equation satisfied by the polynomials. Some sums involving the $R_n(\beta,\gamma;\ x)$ are derived by using Kummer's formulas for a ${}_1F_1$ and one of the generating functions for $R_n(\beta,\gamma;\ x)$. Relations between the $R_n(\beta,\gamma;\ x)$, the Legendre, and the Hermite polynomials are derived. Two integral forms for the $R_n(\beta,\gamma;\ x)$ are given. The behavior of the polynomials for large n is investigated by using Darboux's method for obtaining asymptotic expansions from generating functions. The first term of such an expansion is given for real values of the variable x.

In Chapter 3 a similar study is made of polynomials generated by an Appell F_3. These polynomials also may be written as well-poised hypergeometric ${}_3F_2$'s which may be transformed by Whipple's transformation into a second hypergeometric ${}_3F_2$ form. The properties of this set of polynomials are studied in much the same manner as was done in Chapter 2 for the $R_n(\beta,\gamma;\ x)$.

Microfilm $2.00; Xerox $4.40. 82 pages.

SOME PROPERTIES OF THE SPEARMAN ESTIMATOR IN BIOASSAY.

(L. C. Card No. Mic 59-3735)

Byron William Brown, Jr., Ph.D.
University of Minnesota, 1959

Let the dose-response function in quantal assay be a distribution function with mean μ. An experiment for estimation of μ involves n subjects tested at each of the dose levels $x_i = x_o + id$, $i = 0, \pm 1, \pm 2, \ldots\ldots$, where n, d and x_o are fixed. The Spearman estimator is defined for this infinite experiment and shown to be a random variable with finite mean and variance. Maxima are obtained for the bias, taken over all placements, x_o, of the dose mesh, for (i) all distribution functions and (ii) all unimodal distribution functions with specified maximum slope. These maxima are compared with the sequence of bounds obtained using Euler-MacLaurin formulae. The mean square error of the Spearman estimator is given for x_o randomly chosen over (0,d). The minimum mean square error of the estimator, for random choice of x_o and fixed $n' = n/d$, is obtained for n=1 and $d=1/n'$. As n' becomes infinite the estimator is consistent. The asymptotic variance of the estimator is defined and used to define asymptotic efficiency relative to the information. The only symmetric dose-response function, with μ as a translation parameter, for which the Spearman estimator has full asymptotic efficiency is the logistic distribution. There are distributions (with first moments) for which the Spearman estimator has asymptotic efficiency arbitrarily close to zero. Efficiencies are computed for several distributions; the results for the normal (.9814) and the logistic (1.0000) distributions agree with the computations reported by others. When the scale parameter is unknown the asymptotic efficiency of the Spearman estimator is at least that for the case of scale parameter known.

A finite experiment is considered, with $(2k+1)n$ subjects allocated to $2k+1$ dose levels spaced regularly over the interval $(x_o-a,\ x_o+a)$ where x_o is an a priori estimate

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of μ. Use of a single subject at each dose level is shown to minimize the maximum variance of the Spearman estimator over all distributions and computations indicate that this design minimizes the variance of the Spearman estimator for the normal distribution. Computations for the normal distribution show that the ratio of the inverse of the information relative to the mean square error of the Spearman estimator for many of the usual experimental design situations is larger than unity over all choices of x_o.

The finite experiment is considered for situations in which a parametric estimator based on the wrong model is used. Asymptotic computations for RBAN estimators, based on the angular model, are used to estimate the means of the normal, logistic and uniform dose-response functions. The results indicate that the use of the wrong model has little effect on the asymptotic mean square error of the RBAN estimator.

In conclusion the Spearman estimator seems to merit more attention since it has statistical properties that compare favorably with those of the more popular RBAN estimators and it is much simpler to describe and compute. Microfilm $2.00; Xerox $5.60. 113 pages.

A MATHEMATICAL EXAMPLE DISPLAYING FEATURES OF TURBULENCE.

(L. C. Card No. Mic 59-3991)

Terence Butler, Ph.D.
Indiana University, 1959

Although the Navier-Stokes equations for the flow of an incompressible viscous fluid have proved to be an adequate description for laminar flow, it has not been shown that they describe turbulent phenomena. The complexity of the equations themselves has made a direct approach to the problem too difficult. One alternate approach is to consider analytically simpler systems of equations which retain some of the features of the Navier-Stokes equations. The objective of this paper is to investigate the solutions of such a system, in this case an integro-differential system, for those properties which are of interest in turbulence. This system was devised by Dr. Eberhard Hopf (Repeated branching through loss of stability, an example, Proceedings of the Conference on Differential Equations, University of Maryland, 1955.) to have solutions which are obtainable by elementary means and which display qualitative behaviour similar to turbulence.

The important property of this system is that the solutions, which correspond to the velocity fields of hydrodynamics, are random functions of position and time. In the limit as a parameter having the role of viscosity tends to zero these solutions have a behaviour similar to what can reasonably be expected in the analogous hydrodynamical situation. We consider the joint probability distributions of the values of the velocity at arbitrary points and find that in the limit as the viscosity tends to zero these joint probability distributions are normal distributions in the case of most interest. That is, the normal distributions will be the only probability distributions resulting from applying the central limit theorem of the infinitely divisible laws. The system of equations contains an arbitrary function, more generally a distribution in the sense of Schwartz, whose influence is analogous to that of the boundary in hydrodynamics and the choice of this quantity effectively determines the joint probability distribution resulting from letting the viscosity tend to zero. For a significant class of these distributions in the sense of Schwartz the limit joint probability distributions are normal. The normality of the joint distributions is due to the fact that there is no interaction between the Fourier components of the velocity. Since in hydrodynamics the joint probability distributions are not quite normal, this suggests devising a model with slight interaction between the Fourier components. We find that the velocity at two fixed points becomes, in general, uncorrelated as the viscosity tends to zero. The interesting case in analogy to hydrodynamics is when the correlation is preserved and we find that this can be achieved by shrinking the points together, as the viscosity tends to zero, in a special manner that selects a magnitude, similar to the eddy size in turbulence, as a measure of the distance of correlation. The normality of the limit probability distributions is unaffected by the moving of the points as long as the correlation matrix has a limit. The joint probability distributions of the space derivatives of the velocity field will, in general, also be normally distributed in the limit as the viscosity tends to zero. Each of the above assertions is valid for certain classes of the arbitrary distribution in the sense of Schwartz appearing in the system and representative classes of these distributions are determined in each case.

Microfilm $2.00; Xerox $4.00. 75 pages.

n-DIMENSIONAL QUASI-CONFORMAL MAPPINGS.

(L. C. Card No. Mic 59-3686)

Edward David Callender, Jr., Ph.D.
Stanford University, 1959

Quasi-conformal mappings are best described geometrically as a generalization of conformal mappings. Namely, a conformal mapping transforms infinitesimal circles onto infinitesimal circles; a quasi-conformal mapping transforms infinitesimal circles onto infinitesimal ellipses of bounded eccentricity.

A natural generalization to n dimensions of two-dimensional quasi-conformal mappings is that such mappings will transform infinitesimal hyperspheres into hyperellipses of uniformly bounded eccentricity. It is known that the conformal mappings of space are trivial ones. We hope that the notion of n-dimensional quasi-conformal mappings will provide a substitute for conformal mappings in n space. Very little is known about n-dimensional quasi-conformal mappings and up to this time nothing on this subject has appeared in the literature.

This thesis consists of two independent sections. The first part is based on the analytic definition of quasi-conformal mappings and contains the proof that an n-dimensional quasi-conformal mapping is uniformly Hölder continuous in compact subsets of the domain of definition. It is this result which, in two dimensions, provides the

basic compactness theorems that are needed for the theory of partial differential equations.

The other section is more geometric in orientation although enough differentiability is assumed so that the mapping satisfies the analytic definition. It presents the preliminary properties of geometric n-dimensional quasi-conformal mappings. The notion of extremal length is introduced and it is shown that a fundamental inequality originally due to Grötzsch remains true.

Microfilm $2.00; Xerox $3.00. 48 pages.

MODULAR LATTICES INDUCED BY FINITE GROUPS.

(L. C. Card No. Mic 59-4101)

Harvey Pate Carter, Ph.D.
Vanderbilt University, 1959

Supervisor: Professor E. Baylis Shanks

A lattice L will be said to be induced by the group G if L is isomorphic to the lattice of all subgroups of G. In this thesis we are concerned with lattices induced by finite groups, and it is to be understood that the groups under consideration are finite groups.

Every group induces a lattice, but it is not true that every lattice is induced by a group. Thus, there is the problem of determining conditions on a lattice which are necessary and sufficient for it to be induced by a group.

In this thesis we obtain conditions on a modular lattice which are necessary and sufficient for it to be induced by a group. Except for the modular lattices induced by groups whose representation as the direct product of lattice indecomposable groups contains as a factor a modular pq-group of order $p^{\alpha}q^{\beta}$, $\beta > 1$, this characterization is in terms of lattice properties.

In chapter I, as a special case of modular lattices, we obtain lattice conditions which are necessary and sufficient for a distributive lattice to be induced by a group.

In chapter II, we modify a group theoretical result into the following theorem: A modular lattice L is induced by a group G if and only if each L_i, $i = 1,2,\ldots,n$, where L_i is a member of the decomposition of L into indecomposable lattices, is induced by a group A_i, where the A_i's have relatively prime orders and belong to the following classes of groups: (A) abelian groups, (B) Hamiltonian 2-groups, (C) modular pq-groups.

In chapter III, we determine necessary and sufficient conditions for an indecomposable lattice L to be induced by a group A belonging to one of the three classes given in the theorem above, and if L is induced by a group A belonging to one of these classes, we determine the order of A. We give a summary of our results for each of the three classes.

(A) ABELIAN GROUPS: Conditions are known which are necessary and sufficient for a lattice to be induced by an abelian group. We utilize this result and show that if the indecomposable lattice L is induced by an abelian group G, then the order of G may be determined from the structure of L.

(B) HAMILTONIAN 2-GROUPS: Specific structural properties of a lattice are obtained which are necessary and sufficient for it to be induced by a Hamiltonian 2-group. In order to obtain our result for the Hamiltonian 2-groups, we first derive conditions on a lattice which are necessary and sufficient for it to be induced by an abelian group of order 2^m and type $(1,1,\ldots,1)$ and also conditions on a lattice which are necessary and sufficient for it to be induced by an abelian group of order 2^m and type $(2,1,\ldots,1)$.

(C) MODULAR pq-GROUPS: We show that each lattice L determines at least one modular pq-group G, such that L is induced by a modular pq-group only if L is induced by G.

The appendix contains lattice diagrams which illustrate the results obtained for L(G), G an abelian group of order 2^m and type $(1,1,\ldots,1)$, or G an abelian group of order 2^m and type $(2,1,\ldots,1)$, or G a Hamiltonian 2-group.

Microfilm $2.00; Xerox $5.00. 100 pages.

ASYMPTOTIC VARIANCE AS AN APPROXIMATION TO EXPECTED LOSS FOR MAXIMUM LIKELIHOOD ESTIMATES.

(L. C. Card No. Mic 59-3690)

William Dollard Commins, Jr., Ph.D.
Stanford University, 1959

Let $L_n(t,\theta)$ be the loss incurred in estimating θ by t on the basis of n observations. For bounded L_n which are approximately parabolic for t close to θ, Chernoff (Ann. Math. Stat., Vol. 27, pp. 1-22) defines a normalized loss function $\overline{L}_n^*(t,\theta)$ and conjectures that for the maximum likelihood estimate T_n, $\lim_{n\to\infty} E\overline{L}_n^*(T_n,\theta) = 1/I(\theta)$, where $I(\theta)$ is the information.

This paper gives a proof of Chernoff's conjecture under suitable restrictions. The single parameter and the multi-parameter case are treated separately. The relevant parts of Chernoff's paper are repeated in the introduction. Examples are given to clarify the origin and proof of the conjecture.

The proof of the conjecture resolves into a proof that

$$\lim_{n\to\infty} n\,P\{|T_n - \theta| > K\} = 0 \text{ for any } K>0 \text{ and}$$

$$\lim_{n\to\infty} \int_{|T_n-\theta|\leq} n(T_n-\theta)^2\,dP = 1/I(\theta)$$

for small $K>0$. The proof that the first limit holds is a modification of Wald's proof (Ann. Math. Stat., Vol. 20, pp. 595-601) that the maximum likelihood estimate is consistent. The analysis of the integral involves a modification of the standard proof that the maximum likelihood estimate is asymptotically normal.

The consistency, "efficiency," and asymptotic normality of the maximum likelihood estimate are incidentally re-established under conditions stronger than usual.

Microfilm $2.00; Xerox $3.00. 47 pages.

PROPERTIES OF FIXED POINT SPACES.

(L. C. Card No. Mic 59-3691)

Edwin Hale Connell, Ph.D.
Stanford University, 1959

A topological space X is said to have the fixed point property if for any continuous function f from X into X, there is a point p such that f(p) = p. There are no known characterizations of fixed point spaces. In this paper, the relationship between the fixed point property and several topological properties is studied.

An example is exhibited of a Hausdorff space with the fixed point property which contains no compact subsets except for finite sets. Although a fixed point space X need not be compact, it is shown that every infinite chain of arcs of X has a non void limiting set. An example is presented of a fixed point space Y such that Y x Y contains an infinite chain of arcs with no limiting set. This settles in the negative the rather well-known conjecture that the fixed point property is preserved under the cross product.

Conditions are found under which the fixed point property implies compactness. Under certain other conditions, fixed point spaces are shown to be unicoherent. A simple proof is presented that the unit square has the fixed point property. It is still an open question whether or not the fixed point property is preserved under the cross product for compact metric spaces.

Microfilm $2.00; Xerox $3.00. 26 pages.

AN EXPERIMENT IN TEACHING LOGICAL THINKING AND DEMONSTRATIVE GEOMETRY IN GRADES SIX THROUGH TEN.

(L. C. Card No. Mic 59-3492)

Glyn Jackson Corley, Ph.D.
George Peabody College for Teachers, 1959

Major Professor: John Houston Banks

The Problem

It is the primary purpose of this study to present experimental results on the ability of pupils of junior high school age to study successfully an introduction to demonstrative geometry. An additional purpose of the study is to present data on the comparative ability of pupils of grades six to ten to study an introduction to methods of reaching general conclusions: intuition, inductive reasoning, and deductive reasoning.

The Experimental Procedure

The experimental work is divided into two separate experiments. The first makes a comparison of grades six to ten on basis of achievement in general reasoning. The second compares grades six, seven, eight, and ten on basis of achievement in an introduction to demonstrative geometry.

The units of instruction used in both experiments were organized by the experimenter and taught by him to each participating section. The unit on general reasoning was taught in one week, or five class periods. The sections taking part in the second experiment studied demonstrative geometry for four weeks immediately after completing the unit on reasoning.

The sample sections were selected from the schools of Natchitoches, Louisiana. Under the supervision of the regular teacher the experimenter took charge of each section for one period per day until the experimental instruction and tests were completed.

Since no standardized tests were available, the achievement tests were constructed by the experimenter. By correlating the scores on odd and even numbered items the reasoning and geometry tests were found to have reliability coefficients of .73 and .90 respectively. The geometry test was divided into three parts so that results could be reported separately on knowledge of terms and concepts, understanding of geometric proofs, and ability to use the syllogism for valid reasoning.

Analysis of variance using the treatments by levels design was used for data analysis. Scores made on the Lorge-Thorndike Nonverbal Intelligence Test, Level Four, were used to constitute three I.Q. levels, above 107.5, between 92.5 and 107.5, and below 92.5. Only the upper and middle levels were used in the analysis. An analysis was made for each part of the geometry test as well as the total scores. The main hypothesis tested in each case was that there is no difference in mean achievement of the grades.

The achievement means of the grade samples were also reported graphically to give a picture of the growing ability of students to achieve on the instructional material of these experiments. Smooth curves through or near the points were used to adjust for sampling error.

Conclusions

The ability of pupils to learn geometric terms and concepts is quite well developed at the sixth grade level. This ability improves at a slow, approximately uniform rate as the pupils progress into the tenth grade.

The ability of pupils to understand the three methods of reaching general conclusions and apply them in either geometric or nongeometric situations is moderately well developed at the sixth grade level. The ability is improving at a rapid rate at this level. At the seventh grade level a stage of much slower growth has been entered. This slower rate of increase continues for the next two or three years.

The logical structure of geometry and the proof of theorems in geometry are too complex for comprehension by all but a very few in the sixth grade. The ability to understand this study is much improved at the seventh grade level, after which the rate of improvement is much lower up to the tenth grade.

Microfilm $2.00; Xerox $7.00. 146 pages.

AGGREGATION OF UTILITY FUNCTIONS.

(L. C. Card No. Mic 59-4339)

Edmund Eisenberg, Ph.D.
Brown University, 1959

In the model considered here there are m buyers $B_1, \ldots, B_m$ and n goods $G_1, \ldots, G_n$. Each buyer B_i has a fixed positive income of β_i units of money and acts so as to maximize a personal utility function $u_i(x)$. Each personal utility function $u_i(x)$ is assumed to be defined for all n-tuples x of non-negative real numbers. It is further assumed that $u_i(x)$ is a non-negative real number for every $x \geqq 0$ and that u_i is concave, homogeneous and continuous. A distribution is a collection $x_1, \ldots, x_m$ where each x_i is an n-tuple of non-negative real numbers. We define a social welfare function Ψ for every distribution by:

$$\Psi(x_1, \ldots, x_m) = \prod_{i=1}^{m} u_i(x_i)^{\beta_i}$$

For a given supply s, where s is an n-tuple with each component of s positive, we say the distribution $x_1^o, \ldots, x_m^o$ is maximal if it maximizes $\Psi(x_1, \ldots, x_m)$ on the set of all distributions $x_1, \ldots, x_m$ such that $\sum_{i=1}^{m} x_i \leqq s$. Also, a distribution $x_1, \ldots, x_m$ is an equilibrium distribution if $\sum_{i=1}^{m} x_i \leqq s$, there exist prices p such that each x_i is demanded by B_i at prices p, and $ps \leqq 1$.

We show that every maximal distribution is an equilibrium distribution and conversely. We also show that, for our model, there exists a single buyer with a well defined utility function and income $\sum_{i=1}^{m} \beta_i$ whose demand, at all prices, is the sum total of the buyers demands.

As a tool in showing the above we prove a generalization of the duality theorem for linear programming. It is stated as follows: let A be an m x n matrix, b an n-vector and φ a concave, homogeneous, and continuous function on R_+^m, with the properties that $xA < b$ for some $x \varepsilon R_+^m$ and also if $x \varepsilon R_+^n$, $x \neq 0$ and $xA \leqq 0$ then $\varphi(x) < 0$. Consider now the two problems:

1. Find x such that $\varphi(x)$ is maximal subject to $x \varepsilon R_+^m$ and $xA \leqq b$
2. Find y such that by is minimal subject to $y \varepsilon R_+^n$ and $xAy \geqq \varphi(x)$ for all $x \varepsilon R_+^m$.

The conclusion is: (1) has a solution x_o if and only if (2) has a solution y_o in which case $\varphi(x_o) = by_o$.

Microfilm $2.00; Xerox $3.60. 49 pages.

LIMITING DISTRIBUTIONS FOR SOME MODELS IN INVENTORY THEORY.

(L. C. Card No. Mic 59-3697)

Augustus Jerome Fabens, Ph.D.
Stanford University, 1959

A new approach to the solution of many inventory problems is developed from W. L. Smith's theory of semi-Markov processes. Two basic theorems in semi-Markov processes are proven, which permit us to relate the limiting distribution of a Markov chain imbedded in a process, X(t), to the true limiting distribution in time,

$$F(x) = \lim_{t \to \infty} \Pr\{X(t) \leq x\}.$$

By means of this and other techniques, limiting distributions of the stock level, X(t), are determined for several inventory problems in continuous and discrete time and space. The models are extensions of the "(s, S)" model of Arrow, Harris, and Marshak. In this model a stochastic "demand" process gradually decreases X(t) until $X(t) \leq s$, when an order for more stock is placed to bring X(t) back to S. The models studied include ones with delays in delivery of orders, ones with orders restricted to multiples of a certain size, and a model taking into account seasonal variation of demand. One of the models is identified as being mathematically equivalent to two queueing problems, one the classical problem $E_K/G/1$. In addition to the limiting distributions, waiting time distributions and expected length of busy periods are calculated for the queues. The same technique also yields the solution of the finite queue.

Microfilm $2.00; Xerox $3.60. 63 pages.

SOME PROBLEMS CONCERNING THE WOLFOWITZ TWO-SAMPLE TEST.

(L. C. Card No. Mic 59-3648)

Sister Catherine Josephine Gillis, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Gottfried E. Noether

Because it represents the first attempt to utilize the likelihood-ratio method in the nonparametric case, the modified likelihood-ratio test of Wolfowitz is of considerable theoretical interest. Though the test was originally proposed by J. Wolfowitz in 1942, up to the present its properties have not been investigated. The purpose of the present study is to investigate the test to discover alternatives under which it is consistent and to compare it with other nonparametric two-sample tests.

In Chapter II the general nonparametric two-sample problem is stated, and brief descriptions of some of the tests in use are given. The Wolfowitz test based on the statistic $T(V) = \sum_i \sum_j \overline{l}_{ij}$, where $\overline{l}_{ij} = l_{ij} \ln l_{ij} - \ln l_{ij}!$, l_{ij} being the length of the jth run of elements i, i = 1,2, is set forth in greater detail. Chapter III deals with the

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properties of $\overline{x} = \ln\frac{x^x}{x!}$ and the expected values of the number of runs of given lengths.

Wolfowitz proved the asymptotic normality of T(V) under the null hypothesis F(x) ≡ G(x). In Chapter IV of this dissertation the mean and variance of this asymptotic distribution have been derived. For the case of equal sample sizes n, lengthy computations give the value 0.771 n for the mean and 0.390 n for the variance.

The exact distribution of T(V) has been tabulated for $N = m + n \leqslant 10$ and the probability that T(V) is greater than or equal to a given value is given. A comparison with the Wald and Wolfowitz U-test based on the total number of runs reveals that the T(V)-test is, in general, more sensitive than the U-test, in the sense that T takes more values than U. On the other hand, when the combined sample size is $N \leqslant 10$, no sequence falls in the critical region under the T-test without likewise falling in the critical region under the U-test for all levels attainable with the U-test.

A study of corresponding values of T(V) and Terry's $c_1(R)$ reveals no such similarity. In fact, several sequences are found which, though critical under one test, are not critical under the other. The sequence 0011111100, for example, with N = 10, m = 4, gives T(V) = 5.56 falling in the 5 % critical region, while $c_1(R) = 0$. Again, for N = 10, m = 5, the two sequences 1100000111 and 0001111100 give T(V) = 5.45 and $c_1(R) = 0.66$. T(V) lies in the 5 % critical region, $c_1(R)$ is not significant. These three sequences seem to be characteristic of differences in variability, rather than in location.

Finally the following alternative has been considered: $F(x) = x$, $0 \leqslant x \leqslant 1$; $G(x) = 0$ for $x \leqslant 0$, $G(x) = 1$ for $x \geqslant 1$, and $g(x) = G'(x)$ exists, is continuous (with at most a finite number of discontinuities) and positive everywhere in the interval $0 \leqslant x \leqslant 1$. A result of Blum and Weiss has been utilized to show that the T(V)-test is consistent against alternatives for which

$$R = \sum_j \overline{j}\ \frac{a^2b^2}{(a+b)^{j+3}}$$

$$\int_0^1 \sum_{k=0}^{j+2} \frac{\binom{j+2}{k} a^{j+2-k} b^k g^2 [a^{j-2}(1-g^{k-2}) + (bg)^{j-2}(1-g^{k-j})]\,dx}{(a+bg)^{j+1}} > 0,$$

where a/b gives the ratio of the sample sizes m/n. The dissertation concludes with examples of the application of this condition for consistency.

Microfilm $2.00; Xerox $4.00. 72 pages.

PERMUTATIONS AND PRECEDENCE MATRICES WITH AUTOMATIC COMPUTER APPLICATIONS TO INDUSTRIAL PROBLEMS.

(L. C. Card No. Mic 59-3259)

Thomas Russell Hoffmann, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor Ronald L. Daggett

Explicit enumeration of all possible permutations of a set of N elements and the subsequent application of a criterion to select the optimum sequence can theoretically lead to the solution of several types of Operations Research problems. From a practical standpoint however, complete enumeration is usually too time consuming. But many, in fact often most, of the N! possible permutations listed may not even be feasible since restrictions, such as stating that certain elements must precede others, rule them out.

Presented in this dissertation is a generalized method involving precedence matrices which generates only those relatively few sequences which are feasible and thus makes the technique of enumeration practical. Specific application of this method with the modification of considering only feasible combinations, rather than permutations, is made to the optimum balancing of manual assembly lines. Case studies of an engine assembly and a power saw assembly illustrate the applicability of this technique to actual industrial problems.

Since the techniques are entirely systematic and objective it is possible to program them for digital computers. Programs for the IBM 650 and 704 machines are given as well as flow diagrams. Discussion of the economics of machine vs. manual methods is included.

Microfilm $2.45; Xerox $8.60. 186 pages.

CYCLES IN LOGICAL NETS.

(L. C. Card No. Mic 59-4927)

John Henry Holland, Ph.D.
University of Michigan, 1959

The methods of logic are used in this paper to analyze the effect of feedback in discrete systems. The analysis is carried out by using logical nets as abstract representations of discrete systems with the feedback loops being represented by cycles in the logical nets. With this formalization, statements about feedback logically imply statements about system behavior. Changes in two kinds of behavioral properties are related by the paper to changes in the complexity of structural cycles:

1) properties of the first kind depend upon the fact that the net-state sequence of a logical net is periodic if its input-state sequence is periodic;

2) properties of the second kind deal with various characteristics of state cycles in the state transition graph.

Part 1 of the paper introduces the problem and Part 2 gives rigorous definitions for the concepts just mentioned and related concepts.

Part 3 makes direct use of the fact that a periodic input-state sequence produces a periodic net-state sequence. It considers the spectrum of nets in which all net cycles are simple (have no sub-cycles). The results indicate the oversimplification present in the idea that the main function of cycles in a system is to provide storage of information. It is shown that although a net may have arbitrarily many net cycles of arbitrary lengths its behavior will be severely limited if the net cycles are limited in the complexity of their feedback patterns.

Part 4 considers various characteristics of the state

cycles of input-independent net cycles, beginning with simple cycles and working step-by-step to the general input-independent case. The procedure is such that after each step one or more definitions and operations are introduced to enable the extension to the next step. Part 5 extends the results of Part 4 to the general case of net cycles with input. The final theorem in Part 5 can be interpreted as follows: An (n,r)-cycle is essentially a net cycle having n delay elements and at least one switch with r feedbacks and none with more. Let $B_j(n,k)$ be a black box having the following properties:

1) n observable outputs each of which is a delay element output,

2) k inputs (net inputs) whose states at t = 0,1,2,... are specified by the observer,

3) an arbitrary number of elements in the box all belonging to one and the same cycle.

The set of behaviors possible for the set of all $B_j(n,k)$ which contain an (n,r)-cycle properly includes the set of behaviors possible for any collection of $B_j(n,k)$ which contain an (n',r')-cycle such that $n' \leqslant n$ and $r' < r$.

Part 6 summarizes the definitions and operations connecting the case of input-independent simple cycles with the general case of cycles with input. The paper concludes with the following conjecture: Let $N_{(n,r)}$ be the set of all logical nets containing only (n,r) cycles and let $B_{(n,r)}$ be the set of "input-output" transformations associated with the set $N_{(n,r)}$. It is conjectured that the $B_{(n,r)}$ can be arranged in a lattice as follows:

1) $B_{(n,r)}$ properly includes $B_{(n',r')}$ if $n' < n$ and $r' \leqslant r$ or if $n' \leqslant n$ and $r' < r$;

2) g.l.b. $[B_{(n_1,r_1)}, B_{(n_2,r_2)}] = B_{(n_0,r_0)}$ where $n_0 = \min(n_1,n_2)$ and $r_0 = \min(r_1,r_2)$;

3) l.u.b. $[B_{(n_1,r_1)}, B_{(n_2,r_2)}] = B_{(n_3,r_3)}$ where $n_3 = \max(n_1,n_2)$ and $r_3 = \max(r_1,r_2)$.

Microfilm $2.00; Xerox $3.80. 66 pages.

FEEDBACK METHODS IN CIRCUIT THEORY.

(L. C. Card No. Mic 59-3800)

Bob Albert Jessup, Ph.D.
State University of Iowa, 1959

Chairman: Professor Lawrence A. Ware

As originally planned, the research project for the doctorate thesis entitled "Feedback Methods in Circuit Theory" was aimed at explaining feedback with basic mathematics and obtaining source material from Bode's famous treatise for the purpose of bringing some of the advanced topics in network analysis to the undergraduate level of the electrical engineering curriculum. However, during the process of successfully reaching this goal, the scope of the work became magnified to the extent that all effort has been directed toward preparation of a manuscript suitable for development as a text on circuit theory.

There is a strong feeling that the difficulties encountered in the teaching of network theory are not limited to the feedback problem; the problem actually is one of communicating information via mathematics. Without doubt, the simplest of principles, namely, that the science of mathematics is concerned with the communication of human thought processes, guided the preparation of this dissertation. Unless this principle is observed carefully in presentations of circuit theory which -- as every electrical engineer knows -- is composed of mathematics and little else, the engineering student may be inclined to view the whole of mathematics as a veritable junkyard of sterile relationships; his study of technical subjects becomes a struggle with mathematics. In electrical engineering, circuit theory establishes the mode or pattern for communicating information; the manner of presenting the mathematics is the big problem.

The manuscript, programmed in three parts, deals with the mathematics of feedback. Part I, describing transmission computations in linear networks, consisted of 265 typewritten pages completed in September 1956. It still stands as the only honest appraisal of Bode's methods in existence. Part II was to have covered stability computations with emphasis on such math topics as the properties of the complex number system, continuity, the elementary functions, polynomials, rational functions, root-loci, and Nyquist diagrams. But Part II, temporarily at least, has been scuttled because of the need for demonstrating that the whole subject can be constructed upon a finite linear mathematical basis. Part III furnishes the required mathematical background, but the final copy, which will utilize illustrative examples from Parts I and II, must wait.

The thesis as submitted to the Dean of the graduate College consists of the first three chapters of Part I, and an Appendix entitled A FINITE BASIS FOR THE OPERATIONAL CALCULUS. The ideas which motivated the development of this finite basis were realized in 1955 after a study of E. A. Guillemin's "Introductory Circuit Theory"; but the Appendix speaks for itself, and presents, in the form of examples, the few topics of Bode's feedback theory already contained in Part I beyond the first three chapters.

That this presentation of applied mathematics is not to be found elsewhere in the literature is a matter to be emphasized. This marks the first time that anyone, using only basic algebra and the elements of the calculus, has placed the Heaviside Operational Calculus on a solid foundation. But the students of today need not be penalized for the failure of the pseudo-theorists, during the past fifty years, to recognize what lies behind the simplicity of the Heaviside approach. Nor should those who are seriously concerned with engineering education be forced to accept the offerings of writers who "manu-fracture" circuit theory through frantic efforts to escape from the influence of Bode, on whom they are so completely dependent for their ideas. People are in such a great rush these days to use mathematics, not many can afford an understanding of what they are using. And that is why an explanation of Bode's technique, using basic mathematics, should be published for all to see.

Microfilm $3.60; Xerox $12.20. 280 pages.

A STRUCTURE THEORY FOR A CLASS OF LATTICE-ORDERED RINGS.

(L. C. Card No. Mic 59-4153)

Donald Glen Johnson, Ph.D.
Purdue University, 1959

Major Professor: Melvin Henriksen

The foundations of a systematic general theory of lattice-ordered rings were laid by Birkhoff and Pierce in 1956 (An. Acad. Brasil. Ci. 28 (1956) pp. 41-69). They introduced, as an object for further study, the class of f-rings. This special class of lattice-ordered rings displays a rich structure: it can be characterized as the class of all subdirect unions of ordered rings. Birkhoff and Pierce obtained many properties of f-rings, basing their structure theory on the "l-radical" of an f-ring. In a later paper (Duke Math. J. 23 (1956) pp. 253-261), Pierce obtained an important decomposition theorem for f-rings with zero l-radical. This thesis continues the study of the structure of f-rings.

In Chapter I, we present the necessary background material and obtain a characterization of the l-radical of an f-ring that yields a new proof of the decomposition theorem of Pierce.

In Chapter II, we present a structure theory for f-rings based on an f-ring analogue of the Jacobson radical for abstract rings. In Section 1, we define the J-radical of an f-ring A to be the inter-section of the maximal modular right l-ideals of A. In Section 2, the J-radical is characterized in terms of the notion of l-quasi-regularity, and this characterization is used to obtain certain properties of the J-radical.

In Section 3, we consider a representation theory for f-rings. We show that every f-ring that has a faithful, irreducible, l-representation is a totally ordered ring with identity that contains no non-zero proper one-sided l-ideals.

In Section 4, the notions of l-primitive f-ring and l-primitive l-ideal are introduced. The central result is: an f-ring is l-primitive if and only if it has a faithful, irreducible, l-representation. As consequences of this we have: 1) Every maximal modular right l-ideal is a two-sided l-ideal. 2) The J-radical is the inter-section of l-primitive l-ideals, hence it is a two-sided l-ideal. 3) An f-ring has zero J-radical if and only if it is isomorphic to a subdirect union of ordered rings with identity that contain no non-zero proper one-sided l-ideals.

In Section 5 of Chapter II, we characterize the subdirectly irreducible f-rings and consider the special results obtainable for f-rings that satisfy the descending chain condition for l-ideals. Section 6 treats some special questions that arise during the course of the earlier part of the chapter.

In Chapter III, we consider the problems of imbedding an f-ring as a right l-ideal (respectively, as a sub-f-ring) of an f-ring with identity. In general, neither type of imbedding is possible. With each f-ring A, we associate a ring extension A_1 of A with identity, and we define a partial ordering of A_1 (the "strong order") that extends the partial order on A and makes A_1 into a partially ordered ring. The main results are: 1) A can be imbedded as a sub-f-ring of an f-ring with identity if and only if A_1, with the strong order, can be imbedded in an f-ring whose identity element is that of A_1. 2) A can be imbedded as a right l-ideal in an f-ring with identity if and only if A is what is called an "f_D-ring" and the strong order makes A_1 into an f-ring. Special results are obtained for ordered rings.

In Chapter IV, we consider the existence in f-rings of one-sided l-ideals that are not two-sided. In Section 1, we present an example of an ordered ring without non-zero divisors of zero that contains a one-sided l-ideal that is not two-sided, and we show that every such ordered ring contains a subring isomorphic to this example. In Section 2, we briefly consider the problem for larger classes of f-rings.

Microfilm $2.00; Xerox $6.00. 122 pages.

HILBERT'S FORMALISM AND THE DEVELOPMENT OF GEOMETRY.

(L. C. Card No. Mic 59-4071)

Morton Roy Kenner, Ph.D.
Columbia University, 1959

This study is an exposition and clarification of Hilbert's formalism. Inasmuch as Hilbert's formalism grew out of his own work in the foundations of geometry, Part I of the study traced the abstractive tendencies in the development of geometry from Greek times. In particular, the nature and assumptions of Greek geometry were considered, the development of projective geometry in the 17th century was studied, and finally the development of synthetic and non-Euclidean geometry in the 19th century was analyzed. The emergence of an abstract view as to the nature of geometry was thus established.

Part II of the study first analyzed in detail Hilbert's early work in the foundations of geometry. This analysis showed that Hilbert moved informally to a higher level--the level of metageometry--in his foundations work in geometry. In particular, his concern with the method of models, non-contradiction, and independence in an axiom system was discussed in detail. Examples were used from Hilbert's work. Part II of the study then considered the inadequacies of this informal metageometry and showed how Hilbert hoped to overcome these inadequacies by a simultaneous development of logic and mathematics. To do this, it was shown that Hilbert created the science of metamathematics. The propositional calculus and restricted predicate calculus were discussed as examples of metamathematical analysis. The study then considered, within the framework of Hilbert's metamathematics, the axiomatic method, consistency, and mathematical existence.

The study then showed that the formalist position is basically embodied in a methodological proposal for analyzing mathematical systems without reference to the possible interpretation which may be given to these systems. It was seen that this, for Hilbert, was the result of considering mathematics as completely abstract. It was shown that consistency becomes a central problem but that the Gödel theorems do not necessarily invalidate the formalist position. It was shown that to a great extent the formalist thesis is vindicated by the accepted goals and activities of the mathematical community.

In conclusion, the study showed that formalism can be regarded as a philosophy of mathematics only if this is interpreted to mean the logical analysis of mathematics. It was seen that mathematics is not a game with symbols for Hilbert and that this interpretation, so prevalent of formalism, is misleading out of context. Finally, it was shown that the central method of mathematics, for formalism, is axiomatics. Thus, a commitment to a belief in abstractness, for formalism, is a commitment to the axiomatic method.

Microfilm $3.60; Xerox $12.20. 279 pages.

SOME RESULTS IN THE THEORY OF HANKEL TRANSFORMS.

(L. C. Card No. Mic 59-3931)

John Sharpless Klein, Ph.D.
University of Michigan, 1959

The class of linear integral transformations

$$H_\nu\{f(\chi)\} = \int_0^\infty \chi J_\nu(u\chi)\, f(\chi)d\chi = \bar{f}_\nu(u),$$

known as Hankel transforms, is investigated, where ν is a non-negative real constant and $J_\nu(y)$ is Bessel's function of the first kind of order ν. The importance of Hankel transforms is a consequence of the fact that the Hankel transform of the differential form in y(x) which occurs in Bessel's differential equation with parameter ν is a simple algebraic form in $\bar{y}_\nu(u)$.

The principal results obtained are of two types. The first type consists of relationships between Hankel transforms of f(x) of different orders. Sufficient conditions in terms of the continuity and differentiability of f(x) for $\chi > 0$ and in terms of the order properties of f(x) as $\chi \to 0^+$ and as $\chi \to \infty$ are used to establish the validity of these results. The importance of these results lies in their application to the derivation of the second type of results, namely, convolution and multiplication properties.

A convolution property expresses the product $\bar{f}_\nu(u)\,\bar{g}_\nu(u)$ as a ν th order Hankel transform of a functional involving f(χ) and g(χ). Convolution properties are established rigorously for transforms of order 2n, n = 0,1,2, ... and are derived formally for transforms of order 2n+1. A multiplication property expresses the product of two Hankel transforms, which may be of different orders, in terms of a ν th order Hankel transform of a functional involving the object functions. Two multiplication properties for Hankel transforms of general order ν and four multiplication properties of order 2n+1, n=0, 1, 2, ... are established. The importance of convolution and multiplication properties is their usefulness in the finding of inverse transforms. Illustrative examples are given in the text.

Finally the application of some of the results obtained to the solution of a boundary value problem involving the Poisson equation for a semi-infinite region is demonstrated. Microfilm $2.00; Xerox $4.20. 76 pages.

COMPACT ZERO-DIMENSIONAL TRANSFORMATION GROUPS.

(L. C. Card No. Mic 59-4232)

Chung Nim Lee, Ph.D.
University of Virginia, 1959

A well-known unsolved problem in the theory of topological transformation groups is to decide whether or not a locally compact group G acting effectively on a manifold X is a Lie group. There are certain cases including Hilbert's fifth problem where the answers are known and are all in the affirmative (see [10]). In this connection, it is sufficient to consider the case where the group G is a compact zero-dimensional group. This is the motivation of our study.

In this thesis, we are mainly concerned with the cohomology (Alexander-Spanier cohomology with compact supports) and local cohomology of the orbit space X/G of a compact 0-dimensional group G acting freely on a locally compact Hausdorff space X. We depend on the Cartan-Leray cohomology theory [2]. Especially on a spectral sequence introduced by Borel [1] for a compact transformation group (G, X). Our principal results are as follows.

(1) If G is a compact group acting freely on a space X such that G acts trivially on $H^*(X, L)$ where L is a principal ideal domain then there exists a spectral sequence E such that

$$E_2^{s,t} \approx H^s(B_G, F^t)$$

and $E_\infty^{s,t}$ is associated with $H^{s+t}(X/G, L)$, where B_G is a classifying space of G in a sufficiently high dimension and F^t is the constant sheaf $H^t(X, L)$ over B_G.

This has been known for a compact Lie group [1]. As a consequence of (1), we obtain an exact sequence

$$0 \to H^{q-1}(X, Z_p) \to H^q(X/G, Z_p) \to H^q(X, Z_p) \to 0$$

where G is a p-adic group with p prime, acting freely on X and trivially on $H^*(X, Z_p)$. This gives complete information about the cohomology of X/G over Z_p for such (G, X).

A space X is said to have property R(n, L) if dim X = n, X has locally constant local n-th cohomology over L and the local cohomology $H_x^n(X, L) \approx L$.

(2) Let G be a $\{p_i\}$-adic group acting freely on a space X with property R(n, Z). Then G contains a p-adic subgroup for almost all $p \in \{p_i\}$. Suppose further that $H^n(X, Z) \approx Z$ and G acts trivially on $H^*(X, Z)$. Then X/G has locally constant local n-th cohomology over Z if and only if G is a finite group.

The first part of (2) implies that any compact connected group without any p-adic subgroups acting on a space with property R(n, Z) is a Lie group. It follows from the second part that if G is a p-adic group acting freely on E^n then the local n-th cohomology of E^n/G fails to be locally constant.

(3) a) If G is a compact 0-dimensional group acting freely on a cohomology n-manifold over the rational field K then X/G is also a cohomology n-manifold over K.
b) If G is a p-adic group with p prime acting freely on a space X with property R(n, Z_p) then X/G has property R(n + 1, Z_p).

(4) If G is a p-adic group acting effectively on a manifold then there is a non-empty open submanifold on which G acts freely. Microfilm $2.00; Xerox $3.00. 49 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

A STUDY OF A MODEL OF A MULTI-COMMODITY DYNAMIC ECONOMY.

(L. C. Card No. Mic 59-4349)

Harry Lighthall, Jr., Ph.D.
Brown University, 1959

A mathematical model of production in which it is possible to produce simultaneously various amounts of N different goods can be described by a set T in N-space, called the technology set of the model. The set T represents those "bundles of goods" which can be produced by one unit of labor in one period of time. Thus, the vector $x = (x_1, x_2, \ldots, x_N)$ is in T if it is possible to produce in one period of time with one unit of labor x_1 units of the first good, x_2 units of the second good and so forth. We deal only with the case where the technology set T is the unit simplex.

We first concern ourselves with the following: suppose there is a group of consumers who wish to buy the products of the given model. Let us say that by the end of t units of time this group wishes to consume a goods bundle $D(t) = (D_1(t), D_2(t), \ldots, D_N(t))$. Such a vector-valued function is called a demand schedule. The problem is to determine whether with the labor which is available the given demand is feasible, that is, whether within the given technology T it is possible to produce in such a way that there will always be enough of each of the various goods to meet the given demand.

We consider two types of models - a discrete model and a continuous model. In the discrete model time takes on only integral values whereas in the continuous model time may take on any non-negative value.

In Theorems I and II we show for the discrete and continuous models respectively that a demand schedule is feasible if and only if at any time t the total demand for the various goods does not exceed the total amount of these goods which may be produced up to time t. We also illustrate each of these theorems with a numerical example and a graph.

In the next section for both the discrete and continuous models we consider feasible demands over a finite period of time and show that under the assumption that for each good the cost of storage per unit of good per unit of time is constant there exists a production schedule with the property that each day's storage cost for that schedule is no greater than the corresponding day's cost under any other production schedule.

We also show that the production schedule does not depend on the actual storage costs for each good but only on the ordering of these costs. That is, one obtains the same production schedule if the storage costs for the goods are changed provided the good which was the most expensive to store remains so and the good which was the second most expensive to store remains so, and so on.

Both models are illustrated with numerical examples.

In the next section we consider for the discrete model feasible demand functions which are periodic, and we show that there is a production schedule which not only allows the inventory of each good to vanish at various times but allows the inventory of all goods to vanish at the same time.

Finally, in the appendix we show that the method used in Theorem I to find a production schedule is not applicable if the technology set T is an arbitrary convex set and we given necessary and sufficient conditions for feasibility over a two day period for a technology set which is not a unit simplex.

Microfilm $2.00; Xerox $3.00. 41 pages.

THE FORMULATION OF CONSTITUTIVE EQUATIONS IN CONTINUUM PHYSICS.

(L. C. Card No. Mic 59-4354)

Allen Compere Pipkin, Ph.D.
Brown University, 1959

Constitutive equations prescribing a tensor of arbitrary rank in terms of displacement gradients and an arbitrary number of vectors are examined. The restrictions imposed upon such relations by form-invariance under rotation of the physical system are obtained. A method of finding the restrictions due to symmetries of the material is outlined, and this method is used in obtaining explicit results for seven groups of symmetry transformations.

One example of such a constitutive equation is the law of heat conduction, generalized to permit non-linearity in the dependence of heat flux on temperature gradient and to take into account the effect of deformation on conductivity. A criterion for the stability of steady-state heat flow is developed, and some simple problems of heat transfer in isotropic incompressible materials are considered. The electrical conductivity of deformable materials is discussed briefly.

Microfilm $2.00; Xerox $5.80. 117 pages.

POLYA TYPE DISTRIBUTIONS IN RENEWAL THEORY, WITH AN APPLICATION TO AN INVENTORY PROBLEM.

(L. C. Card No. Mic 59-3720)

Frank Proschan, Ph.D.
Stanford University, 1959

This thesis has two purposes: (a) to solve the inventory problem stated below, (b) to present some new theoretical results, motivated by the solution, on Polya type distributions arising in renewal theory.

Inventory Problem A complex system is to be placed in the field for a period of time t_o. When a component fails, it is instantly replaced by a spare, if available. The components considered operate independently and are essential to continued system operation, so that a shortage of any component considered results in system shutdown. Only the spares originally provided may be used for replacements.

The system contains d_i components of type i, i = 1, 2, ..., k, simultaneously operating. The length of life of the jth component of type i (component i,j) and its replacements are independent random variables with density $f_{ij}(t)$, $j = 1, \ldots, d_i$; $i = 1, \ldots, k$. The scheduled length of time t_{ij} that component i,j and its replacements must operate during t_o is a constant, $j = 1, \ldots, d_i$; $i = 1, \ldots, k$.

Finally, the cost of a single unit of type i is c_i, i = 1, ..., k.

What choice of n_i, the number of spares of type i initially provided, i = 1, ..., k, will yield maximum assurance of continued system operation during the period $[0,t_o]$ at a total cost for spares $c(n_1, \ldots, n_k) = \sum_{i=1}^{k} n_i c_i \leq c_o$, a constant?

A solution is obtained in the manner of nonlinear programming for the composition of the optimal spare parts kit in the case in which $Q_i(n+1)/Q_i(n)$ is a decreasing function of n, for i = 1, ..., k, where $Q_i(n)$ is the probability that n or less failures of component i occur during $[0,t_o]$. It is then shown that $Q_i(n+1)/Q_i(n)$ is a decreasing function of n whenever f_{ij} is a density possessing the monotone likelihood property, j = 1, ..., d_i.

Obtaining this last result motivated the derivation of some new results on Polya type distributions in renewal theory of the following type:

Theorem If $f_i(t)$ is a Polya frequency function of order k having a continuous first derivative, with $f_i(t) = 0$ for $t<0$, for i = 1, 2, ..., then $p'(n,t)$, the convolution of f_1 with f_2 with ... with f_n, is a Polya type density of order k in n and t, where n ranges over 1, 2, ...

Theorem If $f_i(t)$ are monotone likelihood ratio densities in differences of t with $f_i(t) = 0$ for $t<0$, i = 1, 2, ..., then $\Delta P'(n,t) = \int_t^\infty p'(n+1,u)du - \int_t^\infty p'(n,u)du$ has the monotone likelihood ratio property in n and t jointly, and also in differences of n. ($\Delta P'(n,t)$ is the probability that precisely n events occur during $[0,t]$ if the interval between the $i\text{-}1^{st}$ and i^{th} event is an independent observation from f_i, i = 1, 2, ...,).

These theorems are then applied to the Inventory Problem, extended to include the situation in which the t_{ij} are random variables, with monotone likelihood ratio densities and the successive replacements of a given component have different densities.

For the failure density most commonly characterizing electronic components, the exponential density, an explicit solution of the Inventory Problem is obtained, requiring simple calculation in terms of Poisson densities; a numerical example is worked out.

Finally, an extension of the theoretical results is made to cover the case of densities of random variables which are not necessarily non-negative. Theorems concerning the character of successive convolutions are obtained, but considerably weaker than in the case of non-negative random variables.

Microfilm $2.00; Xerox $3.00. 49 pages.

CONVERGENCE OF INFINITE EXPONENTIALS.

(L. C. Card No. Mic 59-3427)

Donald L. Shell, Ph.D.
University of Cincinnati, 1959

Given a sequence of complex numbers $\{a_j\}$ one may define a sequence of functions $\{a_1^z, a_1^{a_2^z}, \ldots\}$. For certain values of $\{a_j\}$ and z, the sequence will converge and is called an infinite exponential. It is represented formally by $E(a_1,a_2,\ldots;z)$. If $a_j = a$ for all j, then the representation is $E(a;z)$ or more generally $E(a_1,a_2,\ldots a_n;z)$ when $a_{j+n} = a_j$ for all j.

Historically the problem of interest has been a study of the convergence of $E(a;1)$. Almost all work has been confined to the case where a is real. The first serious study was made by Euler in 1777. Recently Thron (1957) proved convergence of $E(a_1,a_2,\ldots;1)$ when $|\ln a_j| \leq e^{-1}$ for all a_j.

In the dissertation a new proof is given for this theorem using infinite series representations of the individual terms of the sequence. The parametric forms $a_j = e^{\alpha_j}$; $\alpha_j = \beta_j x$ where $x = \sup_j |\alpha_j|$ are used. A majorizing sequence is shown to converge. Then using this result all the other sequences are shown to converge.

In the remainder, the parametric form $a = e^{\zeta e^{-\zeta}}$ is used. Using the theory of iteration the maximum possible region of convergence in the ζ- and a-planes is established -- namely $|\zeta| \leq 1$. It is also shown that when convergence occurs, the value of the sequence is e^{ζ}.

Turning attention to the z-plane, an expression is obtained for the radius of a circle of convergence in this plane with center at $z = e^{\zeta}$. The radius is a function of ζ.

Returning to the historical problem, theorems are proved concerning convergence of $E(a;1)$. The two most important are $E(a;1)$ converges if $|\zeta| \leq \ln 2$ and $E(a;1)$ converges if $|\zeta| \leq 10\ \ln 1.1 = 0.9531$. The first is proven by showing that z = 1 is within the above mentioned circle of convergence corresponding to each value of ζ. The second, which is the main theorem of the dissertation, is more difficult. Convergence is proven first on the circle $|\zeta| = \rho = 10\ \ln 1.1$ and the maximum principle is then used to extend the proof to the interior. On the upper half-circle the seventieth term of the sequence, φ_{70}, and its derivative φ'_{70}, are computed at 1000 equally spaced points. These points are all well within the corresponding circles of convergence. A maximum value is also determined for $|\varphi_{70}|$ on the unit circle. A maximum value for $|\varphi'_{70}|$ is obtained by interpolating along the circle $|\zeta| = \rho$, using the computed values on this circle and the maximum $|\varphi_{70}|$ on the unit circle. Finally using this maximum derivative φ_{70} is integrated along the circle $|\zeta| = \rho$ and the resulting values at each point are shown to lie in the corresponding circle of convergence.

Some of the results are extended to the more general case $E(a_1,a_2,\ldots a_n;1)$. Choose $\{\zeta_1, \zeta_2, \ldots \zeta_n\}$ and define $a_j = e^{\zeta_j e^{-\zeta_{j+1}}}$, j = 1,2,..,n-1, $a_n = e^{\zeta_n e^{-\zeta_1}}$. The maximum possible region of convergence is established in the $\zeta_1 \ldots \zeta_n$- space: namely $\prod_{j=1}^{n} |\zeta_j| \leq 1$. Also $E(a_1, \ldots a_n;1)$ is shown to converge if $|\zeta_j| < \ln 2$ for all j.

Evaluation of $E(a;z)$ may be considered as an iteration problem. Under these circumstances there is an associated Koenigs function. A series representation for the inverse of this function is given in theorem 12.

Finally a number of relevant tables have been computed and assembled in the appendix.

Microfilm $3.10; Xerox $10.60. 240 pages.

THE S_j-TEST AGAINST LINEAR TREND.

(L. C. Card No. Mic 59-3654)

Elizabeth Shuhany, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Gottfried E. Noether

The S_j-test proposed by Noether (Two Sequential Tests Against Trend, Journal of the American Statistical Association 51 (1956), pp. 440-450) is a sequential test of the hypothesis of randomness against the alternative of linear trend, which can be expressed as the hypothesis that the joint distribution of $X_1, X_2, \ldots, X_n$ is given by

$$F(x_1, x_2, \ldots, x_n) = \prod_{i=1}^{n} F(x_i + i\theta)$$

The S_j-test is carried out by comparing X_i with X_{i+j}, for fixed $j>0$, and using the sequential probability ratio test of the hypothesis H_0: $p = P(X_i > X_{i+j}) = \frac{1}{2}$ against the alternative H_1: $p = \frac{1}{2} + \epsilon_j$, the test being truncated with j comparisons if a decision has not been reached by that point.

To carry out the S_j-test the value of j is chosen to minimize the expected numbers of observations required by the sequential test. The dissertation provides a chart from which one can read the value of j required for given alternatives θ for $\alpha = \beta = 0.05$ and $\alpha = \beta = 0.01$, where α, β represent the probabilities of type I, type II error respectively. Since the S_j-test is carried out as a truncated sequential test, the effect of truncation on the probabilities of error and on the average sample number is considered.

The S_j-test is compared with Mann's T test, which is the most efficient non-parametric test against trend. It is found that the expected numbers of observations required by the S_j-test are slightly smaller than the number of observations required by the T test. In view of the ease of carrying out the S_j-test compared to the T test, it would seem that the S_j-test represents a useful test against linear trend. In the course of this comparison of the two tests a formula is obtained for the variance of T under the hypothesis of linear trend, for samples selected from the rectangular distribution.

A two-sided sequential binomial test is set up, using two one-sided sequential probability ratio tests, and the method is then applied to set up a two-sided S_j-test. The choice of j is made by considering a type of closed sequential scheme described by Armitage (Restricted Sequential Procedures, Biometrika 42 (1957), pp. 9-26), and a chart is presented to allow estimation of j for any given alternative θ.

In the last section the question of effectiveness of the S_j-test against upward or downward trends which are not necessarily linear and against linear trends with unequally spaced observations is briefly discussed.

Microfilm $2.00; Xerox $4.80. 93 pages.

DYNAMICS OF ELASTIC SYSTEMS UNDER INITIAL STRESS.

(L. C. Card No. Mic 59-3886)

Yih-O Tu, Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: Professor George H. Handelman

The eigenvalue problems associated with vibration and stability of beams under initial axial stress and flat plates under initial plane stress are formulated from variational principles for general structural numbers. These eigenvalue problems can be studied by means of variational principles or through the solution of appropriate differential equations with corresponding boundary conditions. In the case where these eigenvalue problems lead to ordinary differential equations, the associated minimum principles are expressed in terms of two symmetric bilinear forms. These problems are normal and natural according to Ziegler and Kestens; and consequently, the existence and reality of eigenvalues follow immediately.

The ordinary differential equation for the vibration of beam is of the form $u^{iv} + \gamma^2 [\psi(x)u']' = \beta^4 u$, where the initial stress $\psi(x)$ is compressive for $\psi(x)>0$. The corresponding minimum principle shows that critical load γ_c^2, for which $\beta^4 = 0$, exists unless the beam is everywhere under tension. Upper bounds for β^4 may be obtained from minimum principles, in particular Rayleigh quotients. Comparison theorems which provide lower bounds are established for this particular type of eigenvalue problems. The ordinary Southwell's method for lower bounds of the first eigenvalue can be applied directly for the case $\psi(x) \leqq 0$ for all x throughout the entire length of the beam; however, for other cases, similar methods are formulated and proved accordingly. Since these eigenvalue problems are positive definite for either $\psi(x) \leqq 0$ or $\gamma^2 \leqq \gamma_c^2$, and are self-adjoint, the Schwarz iteration method can be used to find both upper and lower bounds for the first eigenvalue. Numerical results computed for the example of linear axial stress by means of simple polynomials have shown that the bounds obtained from Schwarz iteration method are very good for small γ^2 and deviate considerably for large γ^2.

Approximate solutions for small γ^2 can be obtained by the perturbation theory of Rellich for which the perturbed differential operator is of lower order than the unperturbed problem. Numerical results using only a finite number of terms for the above mentioned example are good for small γ^2 compared with bounds obtained from other methods, in particular they are good for the problems for which γ_c^2 exists and is small.

If, however, the beam is everywhere under tension, no critical load exists. Consequently, γ^2 could be very large, and β^4 increases monotonically with respect to γ^2. By writing the differential equation in the form $[\psi(x)u']' + (1/\gamma^2)u^{iv} = (\beta^4/\gamma^2)u$, an approximate solution can be found for large γ by the method of singular perturbation for which the perturbed differential operator is of higher order than the unperturbed one. Numerical results, again using only finite number of terms, for the same example lie mostly within bounds of the eigenvalues even for only moderately large γ^2.

Another numerical example is concerned with a thin,

but long, flat plate simply supported on all edges and subjected to parabolic temperature distribution along its width. The stress is theredore compressive in the central strip and tensile along side strips of the plate. Although exact solutions are not attainable, numerical results from the Rayleigh quotient do indicate the existence of critical loads, an approximate value may be obtained from a perturbation solution.

Microfilm $2.00; Xerox $4.20. 77 pages.

TOPOLOGICAL GROUPOIDS.

(L. C. Card No. Mic 59-4264)

Ronson Joseph Warne, Ph.D.
The University of Tennessee, 1959

Major Professor: Orville G. Harrold, Jr.

A groupoid is a set G in which a single valued product ab is defined for every pair of elements a, b ϵ G. If G is a groupoid and at the same time a Hausdorff topological space, and, moreover, the multiplication in the groupoid G is continuous in the topological space G, then G is called a topological groupoid. Our aim in this dissertation is two-fold: (1) to study topological groupoids for their own sake; (2) to investigate the relation of certain topological properties to associativity.

If a is an element of a groupoid G, we will use the following notation: $\hat{a} = a$, $\hat{a}^2 = \hat{a} \cdot a$, $\hat{a}^3 = \hat{a}^2 \cdot a$, ..., $\hat{a}^n = \hat{a}^{n-1} \cdot a$, etc. An element a of a topological groupoid G is said to have property a if and only if $V(\hat{a}^n)[V(\hat{a}^r)V(a)] \cap [V(\hat{a}^n)V(\hat{a}^r)]V(a) \neq \square$ ($\square$ will denote the empty set) for every triplet of neighborhoods $V(\hat{a}^n)$ of $\hat{a}^n$, $V(\hat{a}^r)$ of $\hat{a}^r$, and v(a) of a for all positive integers n and r. If a ϵ G has property a, all powers of a are unique. In Chapter 2, we will prove theorems relating to idempotents, ideal, etc. Many of these theorems are generalizations of theorems in mob theory. We also discuss connected groupoids. For example, if G is a bicompact, connected groupoid with a unit the minimal closed ideal K of G is connected. In Chapter III, we consider bicompact groupoids with a zero and a unit which are irreducibly connected between 0 and u and which obey the cancellation law, i.e. xc = yc or cx = cy for x, y, c ϵ G with $c \neq 0$ implies x = y. If x, y, and c ϵ G, $x < y$, and $c \neq 0$, then $xc < yc$ and $cx < cy$. If $x \neq u$ and x has property a, then $\{x^n : n \epsilon I\}$, where I represents the positive integers, converges to 0. Our main result states that if every element of G has property a, then there exists a function f from G onto the unit interval [0,1] of real numbers under the usual topology and the usual multiplication, which is an isomorphism as well as an order preserving homeomorphism. In particular, any continuous multiplication on [0, 1] as a space is the usual multiplication of real numbers if the multiplication obeys the cancellation law, 0 acts as a zero, 1 acts as a unit, and every element of [0, 1] has property a. We next study the "associative-like" properties of G. Using these properties, some of the results of mob theory for this type of groupoid are established.

In Chapter IV, we are concerned with monothetic groupoids, topological groupoids with a zero, and quasi-groups. A topological groupoid G is monothetic if there exists a ϵ G such that the collection of all finite "words" in a is dense in G. Necessary and sufficient conditions are given for a monothetic groupoid to be a monothetic semi-group. We next consider the general theory of topological groupoids G with a zero. If a ϵ G and a^n is unique for all n, then a is called a nilpotent provided $a^n \to 0$. A nil left (right, two-sided) ideal of G is a left (right, two-sided) ideal of G which consists entirely of nilpotent elements. If G is bicompact, every right (left, two-sided) ideal A of G is either a nil ideal or contains non-zero idempotents provided every element of A has property a. The groupoid G is said to be an N-groupoid if its nilpotent elements form an open set. If every element of G has property a, then G is an N-groupoid provided there exists a neighborhood V_0 of 0 which consists entirely of nilpotent elements. We give conditions for the radical (union of all left nil ideals) of a bicompact N-groupoid to be open. We show that any bicompact subset of G is bounded. Finally, we consider the special groupoids with a zero mentioned in Chapter III. The concepts of nil ideal, radical, and "arbitrarily small" bicompact ideal neighborhoods of 0 in these groupoids are discussed. We close this chapter with an application of topological techniques to the theory of quasi-groups. A groupoid G is called a quasi-group if for any two elements a and b in G, there exists exactly one x ϵ G such that ax = b and exactly one y ϵ G such that ya = b. It is well known that a finite groupoid that satisfies the cancellation law (ax = ay or xa = ya implies x = y for all a, x, y ϵ G) is a quasi-group. Conditions for a bicompact cancellation groupoid to be a quasi-group are found. Microfilm $2.00; Xerox $3.00. 54 pages.

A LINEAR TRANSFORMATION OF DOUBLE WIENER INTEGRALS.

(L. C. Card No. Mic 59-3771)

David Anson Woodward, Ph.D.
University of Minnesota, 1959

Adviser: Robert H. Cameron

This paper is an extension of Transformations of Wiener integrals under a general class of linear transformations by R. H. Cameron and W. T. Martin. Let C be the class of real continuous functions on the interval [0,1] which vanish at zero and C $\textcircled{X}$ C be the Cartesian product of C with itself. The transformations considered carry C $\textcircled{X}$ C onto itself in a one to one manner and are of the form

$$(1)\quad \begin{aligned} y_1(t) &= x_1(t) + \int_0^1 K_{11}(t,s)x_1(s)ds + \int_0^1 K_{12}(t,s)x_2(s)ds \\ y_2(t) &= x_2(t) + \int_0^1 K_{21}(t,s)x_1(s)ds + \int_0^1 K_{22}(t,s)x_2(s)ds. \end{aligned}$$

The kernels $K_{ij}(t,s)$, i,j = 1,2, are continuous except possibly along the diagonal $0 \leq t = s \leq 1$, so that as a special case we have the transformation

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$$(2)\quad \begin{aligned} y_1(t) &= x_1(t) + \int_0^t K_{11}(t,s)x_1(s)ds + \int_0^t K_{12}(t,s)x_2(s)ds \\ y_2(t) &= x_2(t) + \int_0^t K_{21}(t,s)x_1(s)ds + \int_0^t K_{22}(t,s)x_2(s)ds. \end{aligned}$$

Transformation formulas for double Wiener integrals are given for general classes of transformations of types (1) and (2).

Microfilm $2.00; Xerox $3.00. 42 pages.

MUSIC

THE CONTRIBUTIONS OF PHILIP CADY HAYDEN TO MUSIC EDUCATION IN THE UNITED STATES.

(L. C. Card No. Mic 59-3917)

Chester Newhall Channon, Ed.D.
University of Michigan, 1959

This study aims to trace and evaluate the career of Philip Cady Hayden as a music supervisor and teacher, who, because of his understanding of public school music in the United States, not only edited and published the first successful periodical devoted exclusively to the field of music education--School Music Monthly--, but also rallied the supervisors of the country together to form their own organization--the Music Supervisors' National Conference.

Hayden's early environment, his school days at Penn-Yan Academy and at Oberlin College, and his employment on a daily newspaper aptly prepared him for the niche he carved for himself in public school music. The effectiveness of his work as a musician and teacher is attested by the high regard in which he was held by his students, colleagues, and fellow townsmen on the local level, and by his fellow supervisors, journalists, and educators on the state and national level. Personal interviews with many of these and research into the Yearbooks of the M.S.N.C., the M.E.N.C., the M.T.N.A., the Department of Music Education of the NEA, and the periodicals School Music Monthly, School Music, and the Music Supervisor's Journal give ample proof of the esteem and affection which he was accorded.

Shortly after becoming a member of the Department of Music Education of the NEA in 1892, Hayden's personality and his qualities as a music teacher and supervisor were recognized by its members who elected him to various offices and appointed him to important committees through which he helped shape the policies of that organization for thirty-two years. As a member of this group, he came to realize the need for a journal dealing with the problems of school music and serving as a voice for the profession. The publication, in 1900, of School Music Monthly, later renamed School Music, was the result. From the first this magazine was free from the influence of any clique of supervisors or any publishing company. Its columns were open to all who wanted to discuss any phase of public school music. The volumes of School Music contain reports of association meetings, addresses, discussions, and scores of special articles, all of which constitute a valuable and permanent record of school music ideas and opinions.

In this journal Hayden explained "Ear training in rhythm forms," the name he applied to a system of teaching the elements of music, which he based on the premise that rhythm and tone should not be separated in the teaching of music. Desirous that others might observe and criticize his method, Hayden invited supervisors from all over the country to Keokuk, Iowa, in April, 1907. At this meeting, the Music Supervisors' National Conference was founded. First president of this group, Hayden was active during the remainder of his life in promoting the organization, and was instrumental in helping shape many of its policies.

Three conclusions can be drawn from this study. (1) Hayden's principles of music teaching, especially the presentation in music reading of the written symbol after the ear has absorbed the facts of rhythmic and tonal relationships, have become accepted procedure in school music teaching. (2) The Music Educators National Conference, an organization on which he left his impress and whose current membership is more than 33,000, is the outgrowth of his call for a conference in Keokuk to inspect his work. (3) In the publication of School Music, Hayden gave to public school music teachers and supervisors a magazine which for the first time was devoted to their interests, problems, and discussions.

Microfilm $2.35; Xerox $8.20. 177 pages.

WOODWIND QUINTET and OVERTURE.

(L. C. Card No. Mic 59-3796)

Paul Oscar Harder, Ph.D.
State University of Iowa, 1959

Chairman: Associate Professor Philip Bezanson

ANALYSIS OF WOODWIND QUINTET

This work is in three movements, each of which is related to the others by the cross reference of numerous motives. These short melodic fragments are seldom transferred literally from movement to movement; they are subjected to rhythmic transformations which drastically change their identity. This method of motivic metamorphosis is a logical consequence of the horizontal application of serial technique. Although this composition is based upon the "row" technique, and all material is derived from tones arranged in such a series, the actual technique of composition employed is not restricted by traditional concepts of practice within this medium.

The first movement is in sonata form, and may be analyzed as follows:

Exposition: The first theme extends to measure 12;

measures 13-16 are transitional in character leading to the second theme (measures 17-21); measures 22-28 comprise a second transition leading to a rearrangement of first theme material (measures 29-32); in measure 33 the second theme reappears against motives derived from the first theme. Development: The material is developed by means of traditional techniques except that extremely small units are employed. Recapitulation: The first theme reappears in the flute in measure 74 in larger note values (the original rhythmic movement is regained in measure 78), and is telescoped with the horn melody, which serves as a transition; the second theme is recapitulated in measures 92-105; measures 106-116 serve as a coda, which consists of motives introduced in the first four measures of the movement.

The second movement divides logically into four sections. The entire structure is based upon three themes, which are introduced in the first six measures of the movement. Section I (measures 1-19) expresses a quiet mood of repose, and is predominantly contrapuntal in character. Section II (measures 20-29) features canonic devices. Section III (measures 30-41) is climactic, and utilizes all three themes. Section IV (measures 42-52) is in the nature of a coda, which reaffirms the opening spirit of repose.

The third movement is in rondo form. As in the preceding movements, motives introduced in the first few measures are utilized in various guises in order to achieve unity and integration of material. The sections of the form may be identified as follows: A (measures 1-33); B (measures 34-58); A (measures 59-79); C (measures 80-111); B (measures 112-132); A (measures 133-158). The final twelve measures constitute a coda, which is characterized by strong rhythmic punctuation.

ANALYSIS OF OVERTURE

This work is symphonic in character as opposed to the chamber style of the Woodwind Quintet. Sonata form is employed, and may be analyzed as follows:

A slow introduction presents material which is utilized throughout the work, but its primary function is to establish the character of the composition. The first theme group (measures 25-68) is animated in character; measures 69-76 comprise a transition leading to the second theme (measures 77-97); the exposition concludes with a third (closing) section (measures 98-117). The development section extends to measure 164. The recapitulation opens with the second theme at measure 165, which is infused with material taken from the introduction. It leads eventually to the recapitulation of first theme material at measure 205. Measures 230-238 serve as a coda, bringing the work to a conclusion in the general tonal area of D.

Microfilm $2.00; Xerox $6.80. 141 pages.

FACTORS, DIFFERENCES, TRENDS AND RELATIONSHIPS IN THE ADMINISTRATION AND SUPERVISION OF MUSIC IN FOURTEEN SELECTED SCHOOL SYSTEMS.

(L. C. Card No. Mic 59-3797)

Stanley Lee Henderson, Ph.D.
State University of Iowa, 1959

Chairman: Associate Professor Neal E. Glenn

THE PROBLEMS

I. STATEMENT OF THE PROBLEMS

The problems proposed for this study are:

1. To investigate the current practices, policies, and trends in the administration and supervision of music which influence music programs in fourteen selected mid-western cities.
2. To discover the differences between large and small cities in the administration and supervision of music.
3. To determine the relationships between pupil achievement in music and various factors associated with administration and the music program.

II. METHODS AND PROCEDURES

The Field of Investigation

Fourteen school systems in mid-western cities were surveyed in this investigation. Seven of these cities were classified as large cities and seven as small cities. Data pertaining to Problems I and II were received from all of the fourteen school systems, but data pertaining to Problem III were reported from only ten of these.

Methods and Techniques of Research

The method of research employed in this study was normative survey in that the personal interview, the questionnaire and Evaluative Criteria[1] were used to collect the data. The personal interview technique was used in each school system to collect the data relative to Problems I and II. Data derived from interviews with the music administrators in a school system were supplemented by the author through the observation of music programs and activities in one or several schools. The Evaluative Criteria were used to collect the data pertaining to Problem III. Administrators in each city used the Criteria to evaluate their own school system in the areas of pupil achievement in music, competency of administration, and the efficiency of the music program.

III. CONCLUSIONS

Problem I

On the basis of the data presented in this study the investigator believes that the major factors influencing music programs were: 1) state laws, 2) state laws or interpretations of those laws in regard to the time requirements in physical education, 3) the degree of authority invested in the titular head of music, 4) the length of service of the music director in a school system, 5) budget provisions, 6) policies regulating public performance activities of music organizations, and 7) the adequacy of building facilities.

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Problem II

Current trends in the administration of music indicated by the data presented were: 1) the reduction of the authority of the music director, 2) the over-crowding and expansion of the secondary school curriculum, 3) the scheduling of credit courses in music outside the regular school hours, 4) a greater promotion of elementary school music programs, and 5) the use of television.

Problem III

Factors in administration significantly related to pupil achievement in music were: 1) competency of the administrative staff, 2) educational leadership, 3) management of the teaching load, 4) efficiency of principals and their staffs. Factors in administration which were not related to pupil achievement in music were: 1) size of the administrative staff, 2) methods of selecting teachers, 3) teachers' salaries, 4) administrative organization, and 5) community relations.

Factors in the music program significantly related to pupil achievement were: 1) methods of evaluation--that is, of pupil abilities, progress and scholarship, and 2) instructional activities. Factors in the music program not significantly related to pupil achievement were: 1) elective courses, 2) preparation of the instructional staff, and 3) instructional materials, 4) curriculum organization and 5) physical facilities.

Pupil achievement in music in small school systems was significantly related to administration. In large cities there was no significant relationship between these factors.

Microfilm $2.85; Xerox $5.80. 218 pages.

1. Cooperative Study of Secondary School Standards, Evaluative Criteria, Manual (Washington: Cooperative Study of Secondary School Standards, 1930).

THE INSTRUMENTAL MUSIC OF JOHANN LUDWIG KREBS.

(L. C. Card No. Mic 59-3465)

Jean Horstman, Ph.D.
Boston University Graduate School, 1959

Major Professor: Dr. Karl Geiringer

Johann Ludwig Krebs (1713-1780), a pupil of Sebastian Bach for nine years at the St. Thomas School in Leipzig, was highly regarded by his great teacher as a composer, as a clavier, violin, and lute player, and as a friend. Most of Krebs' instrumental works are discussed in the dissertation and are as follows: organ works - chorale preludes ("Clavierűbung," Pt. I), toccatas, fantasias, preludes, trios; clavier works - four Collections (Preludes, Suite, Ouverture, Concerto), "Clavierűbung," Pt. II (Suite), "Exercice sur le Clavessin" (VI Suites), Suite for the Harpsichord; chamber works - four Solos (violin and figured bass), Six Trios (two flutes and figured bass), eight Sonatas (harpsichord and flute), two lute Concertos (with string accompaniment).

Dual stylistic features, baroque and gallant, are found in most of Krebs' works. The baroque style is very prominent in the organ compositions, the gallant, in the clavier and chamber music. There are a few completely baroque compositions among the organ works (particularly the toccata-type compositions and trios) as well as several purely gallant compositions (particularly the chorale preludes). On the other hand, rarely does one find a baroque movement in the clavier and chamber music. (The second movement of the solo clavier Concerto is modelled after the second movement of Bach's Italian Concerto.) All the Sonatas for harpsichord and flute are virtually free from baroque stylistic influence.

The term baroque, as used in the dissertation, signifies an expression of seriousness, fervency, sincerity, dignity, and often ecstasy and tension. Chromatic or coloratura lines, or lines containing wide melodic skips, may be the vehicles for intense feeling. The texture may be that of an accompanied melody or it may be strictly polyphonic. In addition to these characteristics, Krebs' toccata-type compositions for organ, like those of Bach, also contain free recitative-like sections and virtuoso and chordal passages. In the chorale preludes the chorale tune is held traditionally in high esteem.

The term gallant, as used in the dissertation, denotes an expression of light-heartedness, elegance, and graciousness. Melody is often highly ornamented. Other gallant characteristics are: a semi-polyphonic texture or a transparent, homophonic texture with much parallel movement in thirds and sixths, periodicity, diatonic harmony, many non-structural cadences, gallant keyboard idioms, and uncomplicated rhythm.

Krebs' music is not radical, neither is it monotonously conservative. He avoids the superficial aspects of the gallant style,-- over-decoration, fussiness, snobbish aloofness. He does not imbue his gallant idiom with extreme subjective emotion (as did many of his contemporaries), but his music is nonetheless heartfelt; it expresses frankness, joy, simple dignity. At times one notes even a classical quality of depth and purity. His baroque compositions effectively uphold a most worthy tradition against powerful, radical currents of the Enlightenment which completely disregarded the past.

It is in style that Krebs deviates most from the ideals of his teacher. His forms are generally traditional, particularly in the organ works. For example, the overall forms of many of the compositions in his Collections and "Clavierűbungen" are modelled after compositions in Bach's "Clavierűbungen." The Concertos, having the traditional three movements (f-s-f) established by Vivaldi, also accept the Vivaldi (and Bach) first-movement form, -- a rondo-like alternation between tutti sections (having their own thematic material) and solo sections (having their own thematic material in addition to some tutti material).

None of Krebs' forms are stereotyped. Although most individual movements are based on a single idea, various special features appear many times. Sonata form characteristics are evident in various degrees in several compositions. One noteworthy example is found in the lute Concertos where there is a predominance of two tonal spheres, the tonic and dominant.

A Thematic Catalog of Krebs' clavier and chamber music is included in the dissertation.

Microfilm $4.05; Xerox $13.60. 314 pages.

THE RELATIONSHIP BETWEEN VOCAL GROWTH IN THE HUMAN ADOLESCENT, AND THE TOTAL GROWTH PROCESS.

(L. C. Card No. Mic 59-3467)

Warren Arthur Joseph, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Jack O. Lemons

This study's purpose comprised establishment of bases for determining voice range norms, means, and extremes; concomitant with ascertaining expected incidence and degree of mutation through available school records. These standards were derived through measurement of height, weight, dentition, hip and shoulder breadth, voice range, and biotyping of 907 children of ages eleven to eighteen years.

The paucity of scientific studies concerning voice was manifest, especially in non-speech terms. Hypotheses garnered through painstaking research revealed that: (1) voice did change, (2) pitch deepened progressively, (3) appearance of secondary sex characters corresponded markedly with voice deepening, (4) pubescent indications parallelize permanent molar eruption, (5) somatic and endocrine development influences voice deepening, (6) skeletal development showed most contiguity to voice growth, (7) accurate predictivity feasible result of cross-sectional studies, (8) predictive devices most accurate at ninety-five per cent maturity level, (9) this point reached at 12.5 years and 14.7 years for girls and boys respectively, (10) facial hair or mammary gland development, dependent upon sex, coincident occurrence with voice "change," (11) differing biotypes mature at differing rates.

In devising and perfecting an instrument to accurately record the manifold findings, advice was sought from the staff physician, psychologist, dentist, and dental technician of the Brookline, Massachusetts, Public Schools, where testing would be undertaken. Interview forms were devised whereon ninety-six variables were noted. Co-operation of the Superintendent of Schools, the high school principal, and principals of four elementary schools was elicited. Arrangements were made whereby students would be released from required subject classes to assure random sampling. Independent measurements were conducted with control groups to establish investigatory accuracy. These determined accuracy of .947. Two separate analyses of voice range recordings served to fix their veracity. The resultant materials were formulated for future tabulation onto IBM punch cards and two data-carrying cards prepared for each case. Predetermined resultant findings were produced through data machine functions. As patterns arose, new programs were ordered for further operations.

From the data obtained and the resultant patterns produced, the following conclusions are defensible:

1. Both before and after puberty's onset, as age increases, voice pitch lowers.
2. As overall body structure size increases, voice range lowers.
3. Within each distinct biotyping, larger subjects exhibit lower-pitched voices.
4. In general, the more muscular biotypes have lower voice ranges than the less muscular.
5. Shoulder breadth increase at every age level parallels range lowering.
6. Before age fifteen years and four months, developmental patterns are less clearly discernible than from this point onward.
7. Three of the total number of 517 males tested showed pubertal indications while retaining a pre-pubertal voice range.
8. Low terminal pitch distribution for females and males centered around F-sharp of their respective ranges with peak incidence occurring on F-sharp directly.
9. Pitch range of four subjects considered unclassifiable.
10. A significant number of cases produced isolated overtones in addition to normal voice range.
11. High terminal pitch was related to low terminal pitch in that both were overtones of harmonic series built upon a fundamental tone one octave below the low terminal pitch.
12. A more than casual relationship appeared between attitudes of subjects toward singing and voice range extent.
13. Repeatedly, the first child of more than three siblings evidenced restricted voice range.
14. Further investigations indicated by repeated occurrence of wide range in subjects evidencing sensitive upper-respiratory areas.
15. An equally defensible parallel appeared between subjects devoid of childhood disease and upper-respiratory infection and evidences of restricted range.

Microfilm $2.40; Xerox $8.40. 184 pages.

THE VOCAL CANON OF THE CLASSICAL ERA.

(L. C. Card No. Mic 59-4032)

John David Robinson, Ph.D.
Indiana University, 1959

The purpose of this investigation is to analyze the musical style as well as to discover the social significance of the vocal canon in Europe and England during the classical era.

The study is divided into two parts. The first part commences with a discussion of the English catch and its role in English society during the seventeenth and eighteenth centuries, and continues with a study of the vocal canons written in Europe immediately preceding, and during, the classical era, principally those of Caldara, Mozart, Haydn, Beethoven, Schubert, Kuhlau and Cherubini. Finally, a brief survey is made of the vocal canons written after the classical era up to the present.

Part two consists of a transcription, with commentaries, of an unpublished manuscript of the early nineteenth century entitled, Raccolta di Cento Canoni di Vari Autori. This 172-page manuscript is a collection of one hundred unaccompanied vocal canons with texts for three, four and six voices, written by twenty-five composers. The majority of the canons are attributed to six of these composers: Wolfgang Amadeus Mozart (1756-1791); Theodor von Schacht (1748-1823); Vicente Martin y Soler (c. 1754-1806); Ignaz Wenzel Raphael (1762-1799); Wenzel Joseph Trnka (1782-after 1850) and Gotifredo Jacopo

Ferrari (1763-1842). The handwriting in the manuscript suggests that it was copied by one person, probably after 1800.

The canons are analyzed according to musical style, form and prosody. Since different sources report discrepancies in the texts and authorship of these canons, a comparison is made of some of the canons in the manuscript with identical ones which appear in published editions. For example, it has been discovered that five of the canons attributed to Martin y Soler in the manuscript are assigned by Dr. Karl Geiringer (in the Denkmäler der Tonkunst in Oesterreich, Jahrgang 39) to Antonio Caldara (c. 1670-1736).

It was also found that vocal canons of the classical era are almost invariably rounds, i.e., forms in which the succeeding voices enter at distances which are aliquot parts of the length of the entire composition. As a rule, the entrances of the succeeding parts coincide with phrase-endings.

Due to the brevity of the compositions, they contain very little harmonic variety although suspensions and chromaticism do occur in some cases. Inner imitation (imitation within the voices themselves, beyond that which normally occurs in canonic forms) is prevalent in the canons of Caldara and Mozart.

During the eighteenth century, English catch clubs were formed as a result of an interest on the part of many people in the singing of catches. Although neither the English catch club nor the catch form itself has a counterpart in Europe, a large number of the canons written during the classical era were composed for certain occasions that were social in nature. For instance, Beethoven wrote canons at dinner parties and sent them as informal greetings to his friends and patrons.

After the classical era, the popularity of the vocal canon diminished as glee clubs and various other choral organizations were formed. Today, these choral groups exist in nearly all colleges and universities as well as in large communities where they have, for the most part, lost much of their social value in the interest of perfection in performance.

Microfilm $4.90; Xerox $16.40. 383 pages.

PHILOSOPHY

THREE DIMENSIONS OF PHILOSOPHIC INTELLIGENCE: PRIVATE, PUBLIC, AND VISIONAL IN THE PHILOSOPHIES OF WERNER FITE, JOHN DEWEY, AND GEORGE SANTAYANA.

(L. C. Card No. Mic 59-4057)

John Roy Burr, Ph.D.
Columbia University, 1959

The purpose of this thesis is to describe what the visional dimension of philosophic intelligence should be like in America today in terms of the distinction of the private and the public dimensions of philosophic intelligence as drawn in the philosophies of Warner Fite, John Dewey, and George Santayana. As interpreted by these philosophers, visional intelligence is an ideal, a consummation. Visional intelligence represents the overcoming of the non-visional status of the private and the public as mutually exclusive opposites. This noxious dualism and its consequences are perhaps the chief obstacle to living intelligently with modern experimental science and its effects on human life. In its full scope, visional intelligence is the seeing and understanding of what constitutes the wise or good life. Visional intelligence is the indispensable means for realizing genuine individuality in a collective age.

An act is private in character when its consequences are confined to those directly engaged in producing them. An act is public in character when its consequences affect for good or ill individuals other than those immediately engaged in the performance of the act and so calling forth a public or collective effort to control those consequences by indirect means. The distinction of the private and public in this thesis is thus a functional one and not a dualistic one of two different kinds of fixed essences, substances, or "realities". The private dimension of philosophic intelligence is the viewpoint of the personal; the public dimension is the viewpoint of the impersonal. The personal is the standpoint of the committed agent; the impersonal is the standpoint of the disinterested spectator.

The chapters entitled "The Private Dimension of Philosophic Intelligence" and "The Public Dimension of Philosophic Intelligence" are mainly devoted to a description of the nature of these two dimensions in their non-visional form and to an analysis and criticism of the causes and pernicious consequences of treating these two dimensions as mutually exclusive opposites. How this dualism may be surmounted by means of visional intelligence is indicated. The discussion of the private dimension is carried on in terms of what Fite calls "the point of view of the agent", Dewey "qualitative thinking" and Santayana "literary psychology". The discussion of the public dimension is carried on in terms of what Fite calls "the point of view of the observer", Dewey "knowledge as the outcome of specific inquiries", and Santayana the "psyche". Visional intelligence is a special development of the private and public dimensions.

The concluding chapter "The Visional Dimension of Philosophic Intelligence" discusses the synthesis or integration of the private and public forming the visional dimension. Individual visions are what is seen. In the status of visional intelligence, the private dimension becomes the immediate seeing and enjoying of visions; and the public dimension becomes the sharing, criticism, and clarification of what is seen and enjoyed. The discussion of the visional dimension is carried on terms of what Fite calls "full self-consciousness" and the "society of gentlemen", Dewey "consummations" and the "great Community", and Santayana the "life of spirit" and the

"rational order of society". Visions are visionally intelligent to the extent that they are persuasive. The persuasiveness of a vision depends upon the truth of its factual claims, its meaning, and its capacity for being shared. Religion is the socialization of vision. The contributions of these three philosophers to an understanding of visional intelligence are evaluated.

Microfilm $3.20; Xerox $11.00. 248 pages.

THE LOGICAL STRUCTURE OF EXPLANATORY ARGUMENT WITH SPECIAL REFERENCE TO HISTORY.

(L. C. Card No. Mic 59-4059)

Arthur William Collins, Ph.D.
Columbia University, 1959

Attention is focussed here on the explanation of particular occurrences or events. Criteria for Acceptability are classified as logical, empirical and pragmatic. The independence of logical criteria from subject matter is defended. This fundamental attitude is held in common with the well-known view to the effect that explanations in any field ought to be deductions from natural laws. This law-deduction theory is taken as a point of departure for analysis and is rejected on the grounds that explanations in which we have maximum confidence cannot be reconstructed in conformity with the strictures of the law-deduction model. Examples from history, everyday life and natural science are examined in detail to support this conclusion.

Opposition to the law-deduction theory has been articulated frequently especially by students of history and the social and biological sciences. Teleological, empathic and genetic explanation are examined in order to decide to what extent they provide alternatives to the law-deduction theory. It is concluded that these views are essentially methodological commentary subsidiary to empirical criteria for explanatory adequacy and hence not strictly competitors of the law-deduction theory. For example, the issue of empathy in explanations of motivated behavior is relevant to establishing premisses but not to the logical structure of the explanatory argument.

A new model is introduced by means of which explanatory hypotheses rather than explanations are to be identified. An explanatory hypothesis is a proposition with the form "E because C". The generation of explanatory hypotheses utilizes the statement describing the event to be explained as evidence and involves premisses containing the modal terms "probably" and "plausibly". The modal terms are analyzed to the extent that conditions for accepting the required modal premisses are given in detail.

In general many explanatory hypotheses will be supported for the same explanandum. Two sets of rules are provided which apply to a set of explanatory hypotheses for a given event. By means of these rules it can be decided, first, whether two hypotheses compete with one another and, second, for those that do compete, which of a pair is to be preferred. The procedure for comparative evaluation is not always effective. This reflects the fact that available evidence may not render a rational choice between two proposed explanations possible. A general procedure for comparative evaluation would rely on some form of the concept of degree of confirmation. Since this concept has not been developed satisfactorily the rules of evaluation given here are for special cases only. Most typical cases of explanatory practice would be covered.

Special attention is given to history in the sense that all the views considered have been defended in connection with historical explanation and the theories of several contemporary philosophers of history are discussed in detail. A few problems peculiar to historical explanation are considered. No attempt is made to provide a logical model for historical explanation that is discontinuous with the structure of arguments found in other fields since it is contended that such discontinuity is neither necessary nor desirable. Methodological problems related to explanation in history are only occasionally and obliquely considered. Microfilm $2.35; Xerox $8.20. 177 pages.

CONCEPTS, MEANING AND META-ETHICS.

(L. C. Card No. Mic 59-4220)

Stanley G. French, Ph.D.
University of Virginia, 1959

In normative ethics, which asks what particular things or actions are good, right, etc., we find ethical judgments proper. In meta-ethics, on the other hand, we find answers to questions about (say) the meanings of such terms as 'right', 'good', 'obligation', etc.: meta-ethical answers consist, not of ethical judgments proper, but of logical, epistemological or ontological propositions about the meanings of ethical expressions, the definitions of ethical concepts, or the nature of ethical properties.

In the meta-ethical writings of contemporary Anglo-American philosophers, one finds frequent mention of words such as 'concept', 'meaning', and 'definition'; but one seldom finds an epistemological discussion of how such works are or should be used. One's theory of meaning, of definition or of concepts, if inadequate, might result in a corresponding inadequacy in one's meta-ethics.

In the first part of this dissertation--the epistemological part--the following uses are stipulated and recommended for these three terms: the meaning of a word or expression is its use on a particular occasion; the factors affecting a particular use of a word or expression are referred to by the word 'concept'; a definition is the product of a certain group of related activities, the ultimate purpose of which is to say something about the factors affecting the meaning or meanings of a certain expression. A definition is the product of conceptual analysis.

These verbal recommendations are contrasted with other uses, traditional and contemporary, of 'concept', 'meaning', and 'definition'. Here is an incomplete list of the critiques that the reader will find: (i) the view that a word's meaning is some denoted object; (ii) the view that a concept is a Platonic Idea (an other-worldly entity), or an Aristotelian or Kantian idea (a psychological entity); (iii) Plato's, Aristotle's, and Robinson's theories of definition.

In the final, meta-ethical part of the dissertation, one

of the points argued is that there are no peculiar ethical properties, either natural or non-natural. The senses in which this denial is intended are developed by means of criticisms--epistemological and otherwise--of the central doctrines of such intuitionists as Moore, Ross, Ewing and Broad, and of such naturalists as Santayana, Dewey, Perry, Lewis and Rice.

The central doctrines of the intuitionists and the naturalists are seen often to involve faulty notions of meaning, concepts, and definition. Moore, for example, is a conceptualist, sometimes in the Platonic sense, and sometimes in the Aristotelian sense; and he seems often to be searching for "real" definitions.

From the fact that there are no peculiar ethical properties, it follows that ethical expressions are non-cognitive. Those who have recognized this fact are, generally speaking, the emotivists (e.g., Ayer and Stevenson), and the analysts (e.g., Hare and Nowell-Smith). The former school is criticized for its over-simplified view of the functions of ethical language. The analysts, though their theory of language is more adequate than that of the emotivists, are wrong in arguing that it is "logically odd" (Nowell-Smith) to ask the "open" (Moore) or "limiting" (Toulmin) question. There is something odd about arguing from is-statements about language to ought-statements, or to any kind of value expression. The analysts commit the naturalistic fallacy.

To say that ethical expressions are non-cognitive, is to say that they have no constitutive-meaning, i.e., the use of an expression in order to denote. Ethical expressions possess regulative-meaning. An expression is regulative if it is non-factual, and if it is regulatory or practical. In the final section of the dissertation, an attempt is made to show in what senses ethical expressions can be said to possess regulative-meaning. The regulative function of ethical expressions, though only one of many, is certainly one of the more important conceptual elements.

Microfilm $2.45; Xerox $8.40. 185 pages.

A STUDY OF GEORGE BERKELEY'S THEORY OF LINGUISTIC MEANING: WITH A DISCUSSION OF LOCKE'S ACCOUNT OF LANGUAGE AND A CONSIDERATION OF THE RELEVANCE OF THEIR PHILOSOPHIES OF SCIENCE.

(L. C. Card No. Mic 59-4062)

David Aaron Givner, Ph.D.
Columbia University, 1959

Berkeley's nominalistic account of language is not the result of an attempt to correct inadequacies in the conceptual theory of meaning associated with Locke's doctrine of abstract ideas. Both Locke and Berkeley are nominalists. Differences between their views of meaning can be traced to differences in their philosophies of science and differences in the philosophic purpose behind their theories of meaning. Locke's purpose is to show that because the real essence of things is composed of moving solid particles our ordinary concepts of observable substances do not have their source in a form, species or essence in things. Instead our notions of species or our classifications of things are artificial constructions designed to serve the purpose of communication. The abstract idea is a particular, but it has a universal function by being a sign of a class of things.

Locke's indentification of scientific concept with abstract idea, concept formation with abstraction, and meaning with the designative function of a sign can be related to his preconceptions about science. He was a physician and, therefore, affiliated with the biological sciences. In the seventeenth century general principles in this field of study were of little value. Advances were made by careful observation and piece-meal experimentation. Neither were guided by general principles nor related to a systematic theory. The function of language in this stage of biological science accords with Locke's account of words. Words served as labels to mark and classify the results of observation. Classification was the principal intellectual task. Classification involves abstracting the properties of which a species of things is composed. Hence the emphasis on designation and abstract ideas in Locke's theory of language.

Berkeley's theory of meaning is an operationalism that serves the purpose of adjusting the significance of mathematical science to a common sense realism. This philosophic program was not inherited from Locke but existed especially for Berkeley because he, unlike Locke, believed we immediately perceive the real world. He opposed Locke's reductive assumption that the real world consists of unobservable particles.

Berkeley's account of language was influenced by his interest in mathematical science. This interest suggested to him the context in which problems of language are raised. His competence in mathematics enabled him to consider directly and specifically the philosophic problems posed by seventeenth century physics. In addition the following beliefs can be traced to Berkeley's mathematical outlook: (1) A designative relation between sign and idea is not an essential condition of meaning. This suggested the need of another explanation of meaning. Berkeley found that an operational account of signs satisfied this need. (2) The science of mechanics does not offer causal explanations. (3) Scientific explanation consists in reducing phenomena to general principles which allow us to predict events. (4) The ultimate explanation of language is its pragmatic value and purpose.

Berkeley's operationalism serves his common sense realism by giving contextual significance to the scientific interpretation of nature. The meaning of scientific terms and theories consists of their scientific use and value. They do not map out the structure of a real world that relegates the immediately perceived world to the realm of appearance. This operationalism is based on a belief in the pragmatic nature of the true end of speech and reason. Man is guided in his reasoning and choosing by basic human needs. Vision depends on habits of inference that are formed in the interest of biological adjustment. The mind is designed not for the intuition of ideas but for practical action in response to them. Language is an instrument for this purpose.

Microfilm $2.65; Xerox $9.20. 202 pages.

NECESSITY AND MEANING.

(L. C. Card No. Mic 59-4069)

Judith Jarvis, Ph.D.
Columbia University, 1959

John Stuart Mill's position with regard to the nature of mathematical truths is defended against the sort of attack made in the recent literature. Defense of this position (or, at any rate, my defense of it) presupposes the possibility of distinguishing between necessary truths and contingent statements of fact. A contemporary argument to the effect that no such distinction can be drawn is described; the suggestion is made that this argument can be generalized in such a way that it follows, if the argument is valid, that for no expression "X" is it possible to distinguish between the X's and the non-X's.

As the argument described in Chapter I turns on the request for a criterion, the concept "criterion for" must be examined. In the usage of those who argue against the possibility of distinguishing between necessary truths and contingent statements of fact, "criterion for" is the same as "definition of"; Chapter II, therefore, deals with definition. A broader sense of ostensive definition is introduced first; the narrow sense of ostensive definition (pointing and labelling) is rejected on the ground that it conceals, misleads us as to, certain important facts about the nature of language. Discursive definition is then described, and a distinction is made between a criterion for something being X, evidence that it is X, and a reason for thinking it is X. It is suggested that the argument described in Chapter I is in fact a self-contradictory request for something which is at one and the same time a criterion for something being X and evidence that it is X.

It is claimed that from the fact that an expression has a standard, accepted descriptive use it follows that it refers to or stands for some type of object or property. The relevance of this point to certain disputed issues in philosophy is indicated. The following objection is raised: "X" may have a standard, accepted descriptive use, and hence a referent, but what referent? Mightn't it have exactly the same referent as some other expression "Y" (e.g., where "Y" is a proposed reductive analysis of "X"). This raises the issue, what is it to identify a thing as an X. To delineate the concept "identify as," as concept "see as" is indicated: a man sees that thing as x where "x" is the answer he would give to the question "In virtue just of looking at that thing what would you say it was -- if you had no other reason independent of what you now see for thinking some other description of it would be more appropriate?" -- provided that "x" said by him then, makes sense as an answer to this question. (The answer makes sense only in the context of a certain type of behavior.) A concept "perceive as" is indicated in a comparable fashion. One who identifies a thing as an x (in my use of this expression) must have perceived it as something, though not necessarily as an x, and must be capable of perceiving it as a, b, c, which are criteria for x. A man correctly identifies a thing as x if: 1) anyone would so call it, and 2) either he perceives(d) it as x, or he perceives(d) it as y where y is either a criterion for something being x, or evidence that it is x, or a reason for thinking it is x. Knowing the meaning of the word "x" is being able correctly to identify contexts for the use of "x". "X" and "y" do not mean the same where identifying a thing as x is not the same as identifying it as y. In the case of the philosophical issues indicated at the beginning of Chapter III, none of the expressions "X" mean the same as their proposed reductive analyses, and X's are different from non-X's. One of the values of "X" is: necessary truth. Microfilm $2.55; Xerox $8.80. 193 pages.

PROOF AND THE CASE-BY-CASE PROCEDURE.

(L. C. Card No. Mic 59-4233)

Arnold Boyd Levison, Ph.D.
University of Virginia, 1959

Recent philosophical discussion led by Wittgenstein has created considerable interest in the notion of reasoning by cases. This form of reasoning is often referred to as "the argument of the paradigm case" or "the method of reasoning by standard examples". The purpose of this investigation is to make clear what is meant when philosophers talk about reasoning by cases and to examine in particular the presuppositions of the claim that all kinds of reasoning can be reduced in the end to the form of reasoning by cases. The term "case-by-case procedure" was coined by the contemporary Cambridge philosopher, John Wisdom, who has recently argued in a series of lectures given in the University of Virginia that all forms of proof come in the end to this type of procedure. The views of previous philosophers on this subject fall into two general classifications: those which would disagree and those which would agree with Wisdom's. Those which would disagree belong in the Platonic and Aristotelian tradition, called "substantivism" by the writer. Those which would agree belong in the tradition of Hume, called "proceduralism" by the writer. The former explains the universal and necessary element in human knowledge by reference to objects which are in principle unverifiable, while the latter refuses to countenance this admission of unverifiable objects and seeks to explain knowledge by other means. An instance of a kind of substantivism is Frege's view of the self-evidence of the primitive logico-mathematical truths. The incorrigibility of the primitive truths guarantees the validity of deduction, but this very incorrigibility is difficult to accept without any justification. Wisdom's argument against this Fregeian view is that deductive reasoning is circular reasoning in the end, and that this fact would be a reason for skepticism if the deductive axioms were not justifiable by the case-by-case process. The case-by-case process is not confined to empirical or actual cases but may include conceivable or non-actual cases as well. In fact, according to Professor Wisdom, if empirical statements are proved by reference to actual cases, necessary statements are proved by reference to conceivable cases. Wisdom's arguments do not actually refute the Fregeian view because they assume that even self-evidence must be justified. The Fregeian view, however, is that the primitive axioms do not require any other justification than themselves; that therefore it is incorrect even to attempt to prove a self-evident statement. Consequently, there is a stalemate regarding the conceptual schemes of proceduralism and substantivism. Neither is able to refute the other, if the appeal is to verbalized argumentation such as one might find in a book

of philosophy. But what other source is there for deciding between philosophic schemes? This source must lie outside the context of argumentation altogether, in feeling or immediate experience. We must posit a source of truth and knowledge below the level of verbalized thought, which we use to test the basic philosophical schemes such as substantivism and proceduralism. Proof is a logical notion and must find its place in the scheme along with other logical notions. The validity of a philosophic scheme is only tested by reference to something so broad as "the general consciousness of what in practice we experience", to use the words of A. N. Whitehead. This test reveals the superior coherence and adequacy of substantivism for the interpretation of the indefinite range of the items of experience. Microfilm $2.00; Xerox $7.00. 146 pages.

THE COGNITIVE IMPORT OF ART (WITH REFERENCE TO KANT'S THEORY OF AESTHETIC JUDGMENT.)

(L. C. Card No. Mic 59-4017)

Catherine Lord, Ph.D.
Indiana University, 1959

Kant maintains that the aesthetic experience turns on the harmony (or unity) of the imagination and the understanding, a relationship which occurs without the mediation of a concept. In this dissertation, I examine what is entailed in this relationship and I develop the notion of the aesthetical idea to show that Kant's aesthetics holds the key to the cognitive import of art.

By supplementing Kant's phenomenology of the aesthetic experience, I argue that the unity of the imagination and the understanding fulfills not merely the conditions necessary to cognition in general, but turns on the particular type of cognition which characterizes the recognition of the aesthetical idea. Thus the salient features of the aesthetic judgment (which Kant equates with the aesthetic experience), its disinterestedness and its claim to universality, issue from this recognition.

My argument runs as follows: In both the determinate and the aesthetic judgment, the imagination and the understanding are continuous and share a common intention. In the former, they are differentiated by their functions; in the latter, their functions come together in our unmediated grasp of the significance of the work of art. If the understanding is to be satisfied, the work of art must possess a unity, a form. If the imagination is to be the dominant faculty, this unity must be attained in sensuous terms. There considerations guide my delineation of the aesthetical idea.

I employ Kant's analysis of the artist's activity to show that it involves a process of transmutation which extends from a general conception of subject matter, to the idea for a particular work of art, conceived in terms of medium, and culminates in the aesthetical idea, proper, the idea in the work of art. In this process the understanding is assimilated to the imagination, which is guided by the categories of the understanding, but which freely determines the way in which they are applied. The process involves a fusion of the sensuous and the conceptual which issues into the aesthetical idea.

As the expression of the idea for the work of art, the aesthetical idea is drawn from our world, but it cannot be explicitly referred to the world. It is an indeterminate idea, indeterminate because it cannot be exhaustively defined or paraphrased, an idea because it is amenable to cognitive grasp. Its indeterminacy stems from its concreteness, a fusion of the sensuous and the conceptual which presents thought and, what I shall call, the feeling of thought or an idea and the feeling appropriate to it.

The harmony between the imagination and the understanding occurs in the preliminary entertainment of the aesthetical idea. The unity occurs as the aesthetical idea is fully recognized. The disinterestedness constitutes the condition for the aesthetic experience.

The aesthetic judgment, marking the unity of the imagination and the understanding, imputes general agreement, not as to the specific conceptual significance of the work of art, but as to its attunement to our cognitive faculties, i.e. its "purposiveness." This attunement entails the pleasure characteristic of the aesthetic experience as a whole. Microfilm $2.00; Xerox $4.60. 86 pages.

THE CONCEPT OF PERSONALITY IN WILLIAM TEMPLE'S PHILOSOPHY.

(L. C. Card No. Mic 59-3471)

Jack Francis Padgett, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Peter Anthony Bertocci

This dissertation has two purposes: first, to expound Temple's conception of philosophy and personality; second, to evaluate Temple's use of personality as a philosophical principle to solve problems of moral and social philosophy, philosophy of history, and metaphysics.

Temple begins the philosophic quest with a conception of reality derived from his own religious experience and the doctrines of the Christian faith. He ends where he began, without adequately employing an analysis of the data of experience to discover a conception of reality or to modify his view. Although, as Temple contends, man begins the knowledge venture believing that he can know the world, doubt remains about the veracity of any particular apprehension.

Personal existence represents for Temple the highest level of reality that the World-Process has produced. Man is a psycho-physical organism. Temple wavers between considering mind and body as organically unified and mind as distinct from body. However, the evidence seems to suggest two entities with distinctive characteristics causally interacting and uniquely united.

The chief characteristics of human personality, Temple holds, are purpose, fellowship, and love. Ideally conceived, personal action is purposeful, unifying the total conscious life of the self around some end apprehended as good and expressed through the medium of the body. Temple insufficiently relates this ideal to the demands of experience. No attempt is made to assess psychological interpretations of personality. Nor does Temple explicitly incorporate into his account of personality the self as knower or the self's uniqueness and privacy.

Temple analyzes man's moral dilemma as the self's bondage to itself and its limited vision and inner strength. Man must be possessed by God, contributing only the need to be possessed. But this tends to eliminate the self as a center of value-realization. Temple proposes conscience as man's guide in determining right conduct; whereas, goodness is determined by evaluating the consequences of an act. This dichotomy between right and good seems unnecessary and can be overcome by making obligatory what promotes the best possible results in a given situation.

Temple's social philosophy is a coherent application of his Christian ideal of personality and its primacy to the social order. Freedom, fellowship, and service constitute the basic principles for the establishment and existence of society.

The meaning of history for Temple resides in a new order beyond history in which God and mankind are joined together in perfect harmony and peace. But is there not meaning for the individual in history to the extent that opportunity is offered for personal growth and development? While Temple does not regard man as immortal by nature, he believes that some will be saved; his hope is that all will enter into fellowship with God. The facts would seem to establish only the theoretical possibility of survival.

Purpose alone, Temple argues, offers a self-explanatory principle capable of accounting for the World-Process. Persons appearing in the process suggest a perfect Person not bound by the limitations of human personality. There is cogency in Temple's use of personality as the key-concept for understanding the World-Process. He argues persuasively for a purposive will to account for the universe, but relies uncritically on religious experience and orthodox Christianity as offering definitive interpretations of the nature of purposive will. An ontological-cosmological approach is needed in which one's idea of God is constantly related to the data of experience.

Temple does not construct a systematic philosophy, but he does offer provocative analyses of philosophical problems and suggestive solutions. His most substantial contribution is the formulation of social principles and programs to implement a Christian civilization.

Microfilm $7.10; Xerox $24.40. 560 pages.

SCIENTIFIC CONCEPTS AND PHILOSOPHICAL THEORY: AN ESSAY IN THE PHILOSOPHY OF W. K. CLIFFORD.

(L. C. Card No. Mic 59-4092)

Howard Edward Smokler, Ph.D.
Columbia University, 1959

William Kingdon Clifford's main concern was to show that science could be of great aid in dealing with philosophical problems. He thought that these problems could be, at the least, clarified and, at the most, resolved by examining them in the light of both scientific method and the results of scientific inquiries. The scientific method of explanation, according to Clifford, is distinguished from other methods in two ways: (a) scientific explanations are explanations of novel facts whose connection to the body of knowledge has not been previously understood and (b) science is based upon the assumption of the uniformity of nature.

The major problem for an epistemologist in the empiricist tradition is to show how mathematical knowledge is possible; since mathematical knowledge is necessary and certain it is not verifiable on empirical grounds. Although Clifford accepted this conclusion, he wished to develop a theory of knowledge which would show that it originates in sense-experience. He did work out such a theory, but unfortunately not in enough detail to make it possible to render a final judgment as to its value. His central thesis is that sensory experience is structured by certain principles of organization. These principles serve also as propositions about the world as we experience it. Clifford developed his thesis by showing that geometry and arithmetic are developed in accordance with such principles, and that these sciences organize our experiences of both space and quantity. But Clifford failed to realize that if geometrical and arithmetical statements are interpreted as propositions that are true or false of some subject matter as well as principles of organizing that subject matter, it is almost impossible to give a consistent account of them.

Clifford thought that these principles of organization had evolved over the course of human development as men learned to deal successfully with their environment. Thus, as a consequence of the experience of the race, certain patterns or organization became part of man's inherited mental apparatus. Principles of organization, then, are necessary in the sense that man's biological equipment compels him to experience the world in a certain way, but they are not necessary in the sense that alternative principles of organization are inconceivable. Clifford, as one of the mathematicians who helped to develop non-Euclidean geometries, was perfectly clear on this point.

There are many times when Clifford seems to be almost aware of the difficulties of his own position. He anticipated, without ever clearly stating, a conventionalist view of geometry, and he seemed on the verge of abandoning the concept that scientific knowledge can ever be certain. But the brevity of his life and the range of his interests prevented him from reaching any final and considered position.

Microfilm $2.00; Xerox $6.20. 128 pages.

PHYSICS, GENERAL

SURFACE DEFORMATION AND FRICTION ON SINGLE CRYSTALS OF COPPER.

(L. C. Card No. Mic 59-4212)

John Martin Bailey, Ph.D.
University of Virginia, 1959

Surface deformation, which is important in friction and wear as well as in many other metal properties, has been studied by indentation and by the formation of wear tracks in various directions on (100), (110) and (111) and (211) faces of a single crystal of copper. The surfaces were prepared by a rigorous procedure involving metallographic polishing, electropolishing and annealing in hydrogen. Hemispherically tipped sapphires or steel pins with radii from 17 microns to 1588 microns, served as indenters and styli. A diamond pyramid stylus was also used. Normal and frictional forces were measured. The experiments were conducted in air at room temperature and in hydrogen at temperatures up to 800°C. Deformations on (111) faces were studied by means of an etchant which developed pits at clean dislocations in the deformed regions. The depth of plastic deformation and recrystallization was measured by the electrolytic removal of thin surface layers.

The indentations and wear tracks were surrounded by slip traces caused by the movement of dislocations out to the surface on {111} close-packed planes. Dislocation interactions were observable from the anisotropic accumulation of etch pits around mild indentations made on a (111) face.

The width of the wear track formed varied with the direction of sliding. On (100), maximum groove width occurred in <011> directions, and minimum groove width in <001> directions. On (111), maxima occurred in three $\langle 1\bar{2}1 \rangle$ directions, and minima in the three $\langle \bar{1}12 \rangle$ directions. On all the faces studied, minimum groove width occurred when sliding was normal to the trace of a {111} slip plane.

Wear tracks which were formed at intermediate temperatures recrystallized spontaneously. Recrystallization occurred at 300° to 500°C when using a stylus with 794 micron radius, and at 250°C to at least 800°C when using a stylus with 63 micron stylus under similar loading (15-25 grams) conditions. At higher temperatures, polygonization, as evidenced by lines of dislocation etch-pits normal to the traces of slip planes and by formation of networks of lines of pits, began to replace recrystallization as a recovery phenomenon.

The change in dislocation arrays due to high temperature surface deformation (with depth) was observed. Under the deformation condition described above, plastic deformation penetrated more than 150 microns.

The coefficient of friction in air was found to depend upon the direction of sliding. When using hemispherical styli, friction was greatest in those directions in which groove width was least. Use of the pyramidal diamond stylus produced the opposite result: directions in which groove width was greater were also directions of higher friction. This showed the importance of the shape of stylus used. The coefficient of friction at room temperature was found to increase with loading and with decreasing stylus radius. This was explained by the fact that in the experiments friction resulted from plowing rather than from the shearing of adhesive bonds at the surface. The coefficient of friction in H_2 decreased from 0.6 to 0.7 at room temperature to 0.1 to 0.15 at 800°C when using 63 micron stylus, but was equal to 0.15 to 0.25 at all temperatures when using a 794 micron stylus.

Microfilm $2.35; Xerox $8.20. 179 pages.

GENERAL THEORY OF OPTICALLY COMPENSATED VARIFOCAL SYSTEMS.

(L. C. Card No. Mic 59-3619)

Leonard Bergstein, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: Lloyd Motz

A general analytical theory of optically compensated lens systems of continuously variable power is developed, and an elementary and unique solution is given to the problem of determining the optimum Gaussian (or, thin lens) parameters of an optically compensated varifocal system for any desired operating range of focal lengths and specified limit for the maximum image-plane deviation. It is shown that by proper choice of the system parameters n alternate stationary and relatively fixed (to each other) movable lens components can be arranged along a common optic axis to form an optical system which will have an over-all focal length variable continuously between any two predetermined values upon a displacement of the movable components from their reference position to a maximum value. While the movable interconnected system is being displaced from one extreme position to the other to change the over-all focal length the final image of the system will pass n times through the same position in space. The deviation of the image plane from a predetermined reference plane will thus be zero in n predetermined positions of the movable components. The image-plane deviation at intermediate positions depends mainly on the operating range of focal lengths or magnifications of the system and on the number n of positions of full compensation. The larger the value of n the closer the spacing between the positions of full compensation and the smaller the image deviation becomes at intermediate positions. As a result the maxima of the

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image deviation approach zero as the number of components is increased. The minimum number of required components for a desired operating range of focal lengths is determined by the tolerable limit of the image-plane deviation. The 2n-2 Gaussian parameters of the n-component system are determined by solving a system of simultaneous non-linear equations (which are referred to as the varifocal equations). Although the equations are non-linear a method is developed which leads to an exact solution in a matter of minutes. It is shown that of all the possible solutions of the varifocal equations which will yield n points of full compensation there are only two optimum sets of Gaussian parameters, which give systems having the smallest physical dimensions and with no real images formed in the space between the movable components of the varifocal system proper. At the same time these two systems will require the smallest powers for their components. They will also reduce to a minimum the maximum value of the image plane deviation in the operating region of the lens. In both systems negative and positive components alternate. The general theory is applied to the particular cases of two-, three-, and four-component systems. The varifocal equations are solved for these systems and explicit formulaes are given for the approximate values of their Gaussian parameters. The problem of correcting the image aberrations of varifocal systems is also discussed.

Microfilm $2.30; Xerox $8.00. 174 pages.

EXPERIMENTAL TESTS OF QUANTUM ELECTRODYNAMICS AND SPECTRAL REPRESENTATIONS OF GREEN'S FUNCTIONS IN PERTURBATION THEORY.

(L. C. Card No. Mic 59-3683)

James Daniel Bjorken, Ph.D.
Stanford University, 1959

Four experiments are proposed and discussed as tests of quantum electrodynamics, as applied to photons, electrons and μ-mesons at distances $< 10^{-13}$ cm. These are:

(1) Electron-positron pair production by electrons in hydrogen (tridents);

(2) Wide angle photoproduction of μ-meson pairs in hydrogen with detection of one final meson;

(3) Wide angle photoproduction of μ-meson pairs in hydrogen with detection of both final mesons in coincidence;

(4) μ-meson pair production by electrons in hydrogen.

Taken together with wide angle photoproduction of electron-positron pairs, these experiments will extend our knowledge of electron, photon, and μ-meson "size" to distances $\sim 0.3 \times 10^{-13}$ cm. They are all feasible for the Stanford linear accelerator operating in the 500 Mev-1 Bev energy range.

The analytic properties of Green's functions are investigated in the perturbation expansion. An analogy with electrical circuit theory is used, in which Ohm's law becomes the equation of motion of a free particle. Feynman's auxiliary parameters play the role of "resistances." Utilizing this analogy, the integration over internal momenta may be easily done in a general way, and rules are given for writing down the resultant expression. The Nambu representation is then obtained. It is shown that all singularities of a Feynman diagram are determined by the possible existence of real causal intermediate states. A geometrical method is devised for determining the analytic properties of the vertex function as a function of the momentum transfer to all finite orders of the coupling. The scattering of particles of equal mass is discussed and restrictions on the domain of singularities of the scattering amplitude are found, valid to all finite orders of perturbation theory.

Microfilm $2.00; Xerox $4.40. 84 pages.

TRANSVERSE OSCILLATIONS OF A JET.

(L. C. Card No. Mic 59-4331)

John Bruce Brackenridge, Ph.D.
Brown University, 1959

Many problems of fundamental interest in the general area of fluid flow are concerned with such flow in the presence of a rigid obstacle. In general the flow can be made initially steady, then caused to undergo a change to oscillatory motion of either an ordered or disordered nature. In this dissertation we consider the special case of a thin rectangular jet which issues from an orifice and impinges upon the apex of a rigid wedge which is parallel to the plane of the jet. Such a system displays steady motion or motion corresponding to one of a unique set of ordered oscillatory modes. Which state of motion occurs at a given time, depends upon stream thickness, orifice-to-edge distance, stream velocity, kinematic viscosity, and the previous history of the jet.

This investigation into the characteristics of such a system is organized under three main headings: (1) The ranges of parameters of the system for which it will execute self-maintained oscillations of a given mode, (2) The frequency characteristics for the different modes and (3) The jet configurations. It is found that self-maintained oscillations exist in fluids with a wide range of viscosity. The frequency characteristics were obtained both by means of a stroboscope and a hydrophone; an empirical formula for the frequency is developed. The jet configurations or stream profiles are recorded by means of high speed photography and analyzed.

The experimental results are compared to the predicted results of two current theories and conclusions drawn as to their relative merits.

Microfilm $2.00; Xerox $5.60. 114 pages.

A STUDY OF HYPERCENTRIFUGAL ROTOR TEMPERATURES AND THE DEVELOPMENT OF THE BASIC SCIENCE LABORATORY'S ADHESION MEASURING INSTRUMENT MODEL IV.

(L. C. Card No. Mic 59-3418)

Ralph Carter Brainard, Ph.D.
University of Cincinnati, 1959

The measurement of polymer adhesion can be accomplished by the use of centrifugal adhesion measuring instruments. These instruments consist of a rotor (suspended magnetically in a vacuum) accelerated by means of a rotating magnetic field to a speed whose magnitude is such that a spot of polymer coated on the rotor periphery is cast off due to centrifugal stress.

Although this method produces a rather uniform stress normal to the interface and thus provides a measure of adhesion strength, it has heretofore been impossible to determine the temperature of the rotor at the time when the polymer is cast off. The knowledge of this temperature is desirable since the adhesive strength is temperature dependent. This thesis describes the development of The University of Cincinnati, Basic Science Laboratory's Hypercentrifugal Adhesion Measuring Instrument and a study of the method used to measure the rotor temperature.

One of the major design changes incorporated into this model of the hypercentrifuge has been a revision of the horizontal rotor damping mechanism in order to provide access for a temperature measuring probe. This was accomplished by eliminating the usual damping needle under the rotor and instead producing horizontal stability by means of a movable core in the support coil above the rotor. The instrument also features air core coils in the acceleration system. This results in a minimal heating of the rotor. An automatic acceleration control used to maintain constant torque on the rotor during acceleration is another major feature of this model.

Since the rotor can reach the required rotational speeds only if friction is reduced to an absolute minimum, no physical contact with the rotor is permissible, hence the measurement of its temperature must be determined indirectly by measuring the radiation emanating from the rotor. The temperature sensing instrument is located underneath and in close proximity to the rotor. The probe must not affect the rotor accelerating field to any appreciable degree nor must it affect the magnetic suspension of the rotor.

In order to meet the above requirements, the final sensing instrument consists of a plastic cell enclosing a thermistor which constitutes the actual radiation detector. An additional thermistor serves to compensate for cell temperature. Calibration requires also that the cell temperature be measured.

The sensitivity was found to be reasonably close to that predicted theoretically using the assumption that all radiating surfaces were black body emittors.

Microfilm $2.00; Xerox $4.60. 86 pages.

THE INTERPRETATION OF SOME LOW FREQUENCY PURE QUADRUPOLE RESONANCES.

(L. C. Card No. Mic 59-4333)

Philip Anthony Casabella, Ph.D.
Brown University, 1959

The nuclear quadrupole resonances of N^{14} and Cl^{35} have been observed in solid Cl CN. The quadrupole coupling constants of these nuclei have been measured and interpreted in terms of a set of hybrid bonding structures. In the course of study of the N^{14} resonances, a detailed investigation was made of the shape of the negative wings that occur when Zeeman modulation and phase-sensitive detection are used. The shape of these wings can reveal whether two resonances are due to two nonequivalent positions of the N^{14} nuclei or one position with a nonvanishing asymmetry parameter. A theoretical expression has been derived for the shape of the wings which agrees with the experimental results. In further experiments pure quadrupole resonances have been found for N^{14} in three compounds having a nonvanishing asymmetry parameter for the electric field gradient at the resonating nuclei. The shapes of these resonances demonstrate a decrease in the effectiveness of Zeeman modulation as the asymmetry increases, as the expression for the shape of the negative wings predicts.

Finally, the pure quadrupole resonances for Al^{27} in $Al\,Br_3$ are reported. With the addition of these data, the quadrupole coupling constants of all the atoms in the structure of five Group III halides are known. For these cases it has been possible to determine complete electron distributions for the molecules. In addition, for two of the compounds it has been possible to determine bond angles and establish the existence of bent bonds in the molecules. Microfilm $2.00; Xerox $4.00. 71 pages.

POSITIONAL PARAMETER AND THERMAL MOTIONS OF OXYGEN ATOMS IN CALCITE.

(L. C. Card No. Mic 59-3622)

Henry Chessin, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: Ben Post

An investigation of the thermal motions of the oxygen atoms in calcite has been carried out. Diffraction intensities of the selected reflections of the type hkℓ with ℓ odd (hexagonal indices) have been studied over the temperature range -160° C. to 300° C. Only oxygen atoms contribute to these reflections. Intensities of all reflections of this type, accessible to MoKα radiation, were measured carefully with a scintillation counter.

The single positional parameter of the oxygen atom at room temperature and at liquid nitrogen temperature was first determined accurately by two independent computational methods. At room temperature it is: x = 0.2578, corresponding to a C - O bond distance of 1.286 A. No change in this value of the bond length was detected at 130° K.

The components of the temperature motion of the oxygen

atoms have been determined in two ways: from "directly determined" temperature factors, and from a comparison between observed and calculated X-ray data at room temperature and at 130° K. The r. m. s. amplitudes of vibration of the oxygen atoms along "c", "a" and perpendicular to the "a" direction at room temperature are 0.090, 0.060 and 0.11 A respectively and at 130° K. are 0.074, 0.043, and 0.070 A.

The shapes of the oxygen atoms in electron density plots which isolate the oxygen atoms from the other atoms are discussed and compared with results obtained by others. Microfilm $2.15; Xerox $7.60. 162 pages.

HIGH-RESOLUTION ELECTRIC FIELD-INDUCED INFRARED ABSORPTION SPECTRA OF H_2 AND D_2.

(L. C. Card No. Mic 59-3918)

Charles Henry Church, Ph.D.
University of Michigan, 1959

A high resolution study has been made of the electric field induced vibration-rotation absorption spectra of H_2 and D_2. The induced absorption was modulated at 90 cps by square wave fields of 100,000 volts/cm maximum value applied to a one meter long Stark cell of the light guide type operated at pressures up to thirty atmospheres. The spectrum was analysed by a F/15 vacuum grating spectograph of the Ebert design using a 200 mm. wide grating with 300 lines per mm. double passed. The radiation was detected by lead sulfide photoconductive cells cooled by liquid nitrogen. The small modulated component of the output of the detector was isolated and amplified electronically. White light fringes produced in a Fabry-Perot etalon were used for the determination of the line positions. The absolute intensities of the lines were measured for specific polarization directions in order to calculate the polarizability components of the molecules. The spectral resolution varied between 0.1 and 0.2 cm^{-1}. The probable error in the determination of the transition frequencies was 0.02 cm^{-1}, and that for the values of the polarizability components was 3%.

The ν_{0-1} transitions observed for H_2 included 6 Q branch lines, 4 S lines, and 1 O line that was largely obscured; and the ν_{0-2} transitions, 3 Q lines. For D_2, 5 Q and 5 S lines were detected in the fundamental, and 3 Q lines in the overtone. The spectral resolution used (0.1 to 0.2 cm^{-1}) was comparable to the line widths, A new set of molecular constants was calculated for both H_2 and D_2 to best fit the data, generally within 0.01 cm^{-1}. They differed only slightly from those given by Stoicheff. The ratio of the equilibrium vibrational frequencies of H_2 and D_2 could not be compared closely with the ratio determined by the reduced masses of the molecules because of the lack of a reliable value of ν_{0-3} for D_2. The values obtained for the polarizability matrix elements α_{01} and γ_{01} for both molecules are in excellent agreement with the most recent experimental determinations from static electric field induced absorption and photoelectric Raman and Rayleigh scattering data.

It is concluded that the modulated electric field absorption technique offers the highest sensitivity in the detection of weak vibration-rotation transitions in H_2 and D_2, and yields values of line positions and intensities of comparable or greater accuracy than other available methods. Several changes are suggested that should further improve the technique.

Microfilm $2.00; Xerox $5.00. 96 pages.

THE ONE-DIMENSIONAL ENERGY BAND STRUCTURE OF PERIODIC GAUSSIAN POTENTIAL FUNCTIONS.

(L. C. Card No. Mic 59-3891)

Barry George Cohen, D.Eng.
The Johns Hopkins University, 1959

The energy band structure for a one-dimensional periodic potential is obtained by use of analog computer techniques. The potential employed is made up of the sum of a series of individual wells uniformly spaced in one dimension. The individual wells are Gaussian functions. The solutions are obtained for all values of well depths and for an interesting range of spacings from almost completely separated to almost completely overlapping. The structure of the resulting energy bands indicates that the periodic Gaussian potential is quite realistic in one-dimension. An additional problem -- that of a particle in a single Gaussian potential well -- is also included, and the solutions are tabulated for all depths and widths of the well.

Microfilm $2.00; Xerox $4.40. 83 pages.

INFRARED INTENSITIES, BOND MOMENTS AND BOND MOMENT DERIVATIVES FOR PF_3 AND POF_3.

(L. C. Card No. Mic 59-4107)

Julian Lee Dunlap, Ph.D.
Vanderbilt University, 1959

Supervisor: Dr. Ernest A. Jones

The infrared absorption spectra of the fundamental vibrations of PF_3 and POF_3 were recorded for a series of partial pressures of sample gas. A Perkin-Elmer Model 21 Recording Infrared Spectrophotometer with NaCl, KBr, and CsBr prisms was used to secure these spectra. The measurements were made under conditions such that the Wilson-Wells extrapolation theorem would be applicable: stray light corrections were made for the KBr and CsBr spectra; the spectrometer sample area was enclosed and thoroughly flushed with dry nitrogen while spectra were being obtained of the POF_3 ν_1 band, which overlaps a portion of the five micron to seven micron atmospheric band; and adequate broadening pressures of nitrogen were added to the sample gas for each spectral scan.

The apparent absorption intensity for each spectrum was secured by first replotting the experimentally obtained absorption curves with suitable axes and then mechanically integrating the replotted curve. From the

series of apparent absorption intensities for each fundamental vibration, a value of the absolute absorption intensity was calculated by application of the Wilson-Wells extrapolation theorem. The sets of $\partial u/\partial Q_k$, where u is the molecular dipole moment and Q_k is the kth normal coordinate, were calculated from the values of the absolute absorption intensities.

Suitable sets of internal coordinates (r) and symmetry coordinates (R) were defined, and the transformation matrices (L^{-1}) giving the normal coordinates in terms of the symmetry coordinates were calculated by the Wilson FG matrix method. In the case of PF_3, these and all succeeding calculations were performed for each of the several potential functions characterized by the values of the symmetry interaction force constants of 0, 0.25 X 10^{-3}, 0.50 X 10^{-3}, and 0.75 X 10^{-3} dynes. The potential function for POF_3 was derived by using diagonal terms in the corresponding F matrix. This potential function adequately described the molecular vibrations in terms of a normal coordinate analysis.

The L^{-1} matrices were used to calculate sets of $\partial u/\partial R_j$ from the $\partial u/\partial Q_k$. A number of values for each $\partial u/\partial R_j$ were secured because of the sign ambiguity associated with each of the $\partial u/\partial Q_k$.

On the basis of molecular models characterized by non-interacting bond dipole moments, sets of bond moment equations were derived for each molecule relating the bond moments and effective charges to the various $\partial u/\partial R_j$. These equations were solved and the results tabulated.

In the case of PF_3, it was possible to choose a most reasonable set of solutions to the bond moment equations. This set was:

Class	Interaction Force Constant (Dynes)	Signs of $\partial u/\partial Q_k$	$\partial u_{PF}/\partial r$ (D/A)	u_{PF} (D)
A_1	0.25 X 10^{-3}	(-+)	-11.1	1.07
E	0.00 X 10^{-3}	(-+)	-5.58	1.20

No real difference between the bond moment values from the two symmetry classes was detected. It was shown that the bond moment values are consistent with the present knowledge of the bond structure and static dipole moments of PF_3, and the $\partial u_{PF}/\partial r$ values were interpreted in terms of resonance between canonical structures.

Since there was little internal consistency in the possible sets of solutions for the bond moment properties of POF_3, it was impossible to pick a most reasonable set of solutions. The internal inconsistencies were attributed to the approximate nature of the potential function employed. The nature of this potential function and the possibilities for improving it were discussed. It was concluded that a more accurate interpretation of the intensity data for POF_3 in terms of bond moment properties is probably not possible until data are available on the vibrational spectrum of $PO^{18}F_3$.

Microfilm $2.00; Xerox $6.80. 145 pages.

SCATTERING OF ELASTIC WAVES IN ISOTROPIC MEDIA BY SPHERICAL OBSTACLES.

(L. C. Card No. Mic 59-4338)

Norman Gerald Einspruch, Ph.D.
Brown University, 1959

The method of Ying and Truell for studying the scattering of compressional elastic waves by simple spherical obstacles has been applied to the analysis of scattering of compressional elastic waves by a fluid filled cavity and by layered obstacles in which the core of the layered scatterer is a a) cavity, b) rigid sphere, c) fluid filled cavity, d) elastic material of properties different from those of the surrounding medium. A general expression for the scattering cross section offered to a compressional wave has been derived.

An analysis of the scattering of transverse elastic waves by simple spherical obstacles has been performed. The scatterer has been taken to be a a) cavity, b) rigid sphere, c) fluid filled cavity, d) elastic material of properties different from those of the surrounding material. A general expression for the scattering cross section offered to a transverse wave has been derived.

Microfilm $2.00; Xerox $5.60. 114 pages.

GALVANOMAGNETIC EFFECTS AND THE BAND STRUCTURE OF ANTIMONY.

(L. C. Card No. Mic 59-3625)

Sandor J. Freedman, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: Hellmut J. Juretschke

The energy band structure of antimony is deduced from room temperature galvanomagnetic measurements and their interpretation in terms of a theoretical model. A systematic series of experiments is performed to measure all the 12 independent components of the isothermal resistivity tensor through second order in the magnetic field. This requires a number of independent crystals, but by measuring the same constants on different single crystals, it is possible to obtain an internally consistent set of values for the constants. The galvanomagnetic effects are calculated assuming simple three-valleyed bands for both the valence and conduction bands and energy-independent isotropic relaxation times for the holes and for the electrons. This theory contains 9 parameters; a set of three principal mobilities μ_i for the electrons; and a set of three principal hole mobilities ν_i, an angle of tilt, ψ_1, of one of the principal axes of the electron energy ellipsoids out of the base plans; a corresponding angle of tilt, ψ_2, for the holes; and the carrier density N. Certain relations among the constants predicted by the model are satisfied within experimental accuracy. Determination of the band structure consists of finding those values of the parameters giving best agreement between theory and experiment. The problem of finding the best fit is solved with the aid of an I.B.M. 650

electronic computer programmed to explore systematically a large number of possible solutions. Although many solutions are found, only one set of parameters is found to give good agreement with all measured constants within experimental limits of accuracy. If the "1" directions refer to binary symmetry axes and the "3" directions to those making angles ψ with the trigonal symmetry axis, the parameters have the values:

$\mu_1 = 0.15_4 \times 10^3 cm^2/volt\text{-}sec$ $\nu_1 = 3.5_6 \times 10^3 cm^2/volt\text{-}sec$

$\mu_2 = 4.0_5$ " $\nu_2 = 3.3_0$ "

$\mu_3 = 1.1_8$ " $\nu_3 = 0.13_8$ "

$\psi_1 = 30._7^0$ $\psi_2 = 63._2^0$

$N = 3.7_4 \times 10^{19}$ carriers/$cm^3 = 1.0_5 \times 10^{-3}$ carriers/atom

The band structure parameters are used to explain various Sb data of other authors. Good agreement is found with de Haas - van Alphen data and with the dependence of resistivity on Sn impurity content. Marked disagreement is found when the simple Landau-Peierls theory is used to explain the anisotropy in the room temperature diamagnetic susceptibility.

Microfilm $2.00; Xerox $5.00. 98 pages.

STUDY OF THE ELECTRON-LATTICE INTERACTION IN COPPER AT LOW TEMPERATURES BY THE ULTRASONIC TECHNIQUE.

(L. C. Card No. Mic 59-4340)

John David Gavenda, Ph.D.
Brown University, 1959

Ultrasonic attenuation at low temperatures has been measured in copper single crystals as a function of magnetic field strength and direction for frequencies ranging from 11 to 112 Mc/sec. Both compressional and shear waves were used in a sample cut so that the sound propagates along [001]. In addition, compressional wave measurements were made in samples cut along [110] and [111].

A pronounced oscillatory dependence of the attenuation on field strength has been found, particularly for the [001] sample. The oscillations are periodic in $1/H\lambda$ in agreement with the simple model which attributes them to spatial resonances between electron orbits and the periodic disturbance of the lattice by the ultrasonic wave.

From this model, the electron momentum perpendicular to the direction of the field is inversely proportional to the period in $1/H\lambda$. The momenta obtained for different angles have been used to construct the Fermi surface of copper. It agrees with the Fermi surface proposed by Pippard on the basis of anomalous skin effect measurements in that it appears to touch the Brillouin zone boundary in the [111] directions. However, the ultrasonic measurements show the surface to be more cubical than suggested by Pippard.

Recent theories for the attenuation of compressional waves for a transverse magnetic field and of shear waves for a field perpendicular to both the direction of propagation and the plane of polarization seem to be correct. However, agreement is not found with the theoretical result for a field parallel to the plane of polarization.

A similarity is shown between the high field variations of attenuation and magnetoresistance with magnetic field direction, suggesting that information about the anisotropy of the density of states and relaxation time can be found in this fashion. Microfilm $2.00; Xerox $4.40. 84 pages.

INVESTIGATIONS ON RECRYSTALLIZATION AND RECOVERY OF STRAINED ALUMINUM SINGLE CRYSTALS.

(L. C. Card No. Mic 59-4342)

Robert Edward Green, Jr., Ph.D.
Brown University, 1959

The influence of the state of impurities (dissolved in solid solution or precipitated) on the recrystallization of extended aluminum single crystal wires was investigated, especially with regard to the generation of preferred orientations, growth rates of new crystals during recrystallization, and recovery of the growth rates. The crystals contained 99.79% aluminum, 0.09% iron, 0.09% silicon and 0.03% zinc; only the iron was not well within its solubility limit.

No preferred orientations were obtained when the crystals were annealed for several hours at 620°C prior to deformation. Upon reheating at temperatures below 500°C, the yield point of the crystals increased, reached a maximum and finally decreased; this is a typical behavior correlated to the precipitation of a second phase (probably an iron silicon compound). Recrystallization produced preferred orientations in samples which were reheated until the maximum yield point was reached or exceeded. This result indicates that iron in supersaturated solid solution prevented the generation of preferred orientations while it had no effect of this kind when precipitated.

The effect of the state of impurities explains contradictory results previously obtained by different groups (Graham-Cahn, and Liebmann-Lücke-Masing) investigating growth rates and preferred orientations in the recrystallization of aluminum single crystals.

The initial growth rate of strain-free nuclei into deformed matrices was also found to be strongly dependent on the state of the iron; the larger the iron precipitates the faster was the initial growth rate.

Curves of recovery of the growth rate plotted versus reheating time showed a maximum at the same point as did the yield point curve. These curves indicate that recovery was greatest when the iron precipitates were at a critical size and separation; precipitates at this critical size and separation produced the maximum hardness.

The relation between the amount of extension of the matrix crystals on the growth rates of new crystals was also investigated; it was found that the growth rate increased as the amount of extension was increased.

It has been found that the state of impurities and thus the thermal history of the deformed matrix material has a strong influence on preferred orientations, growth rates,

and recovery during recrystallization. In connection with other recent results,* this indicates that extremely small amounts of impurities play a key role in the recrystallization of metals especially in the generation of preferred orientations. Microfilm $2.00; Xerox $4.20. 80 pages.

*Aust, K. T., and Rutter, J. W., General Electric Research Laboratory Report No. 58-RL-2056, (1958).

RELATIVISTIC MECHANICS OF ELECTRIC POINT CHARGES.

(L. C. Card No. Mic 59-3628)

Alexander L. Harvey, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Adviser: Peter G. Bergmann

During the past ten years, Bergmann and coworkers have been investigating the formal properties of field theories which are covariant with respect to general coordinate transformations. The general aim of that program is the construction of a consistent theory of quantized fields. From the point of view of the present paper, the chief feature of that program has been the extensive use of invariant, infinitesimal, canonical transformations, i.e. that group of infinitesimal transformations which, for a given dynamical system, will map solutions of the equations of motion onto solutions. The formal techniques involved have now been developed to the point where they can be applied to a specific theory.

In this paper, a classical theory of electrodynamics is constructed as a preliminary to the formulation of a theory of quantum electrodynamics. This is accomplished by postulating an action principle for an electromagnetic field in interaction with charged particles. The field is divided into an "external field" and "self-fields" (of the particles). The self-field terms contain the usual infinite self-energies of classical point particles but these infinities are eliminated by classical mass renormalization.

Such an action principle leads to the usual Maxwell free-field equations for the external field and to ponderomotive equations for the particles wherein each particle is subject to the influence of the free field and the self fields of all the other particles. But, for the purpose of this paper, the free field is set equal to zero and only two particles are considered. In this case, the only fields present are the self-fields and since these may be given explicitly in terms of the dynamic variables of the particles, the action principle is thus reduced to the type introduced by Fokker. The subsequent treatment is handled solely in terms of these dynamic variables, the point being ultimately to construct a complete set of Poisson brackets for these variables.

The self-fields are taken to be half the sum of the advanced and retarded Lienard-Wiechert fields and in this formulation, the second of the classical difficulties (the first being the infinite self energies), the radiation reaction, is also eliminated, and with it the "runaway" solutions of the equations of motion. Reduction of the action principle to the type of Fokker's eliminates the question of gauge invariance and the infinite number of degrees of freedom associated with the fields is also eliminated. There is some reason for believing that some of the problems of quantum electrodynamics are thereby avoided, whereas others present themselves in a new context.

It is assumed then that the number of degrees of freedom is finite, i. e. limited to just the initial positions and velocities on an arbitrary space-like hyper surface. The invariant transformations are those generated by constants of the motion. The constants of the motion are computed in explicitly time-dependent form and the corresponding infinitesimal transformations are determined. Next their commutators are found. It is also determined that the invariant transformations form a group. Further, since the constants of the motion constitute a function group their Poisson brackets are immediately determined.

The obtaining of the set of Poisson brackets was the aim of this paper. The set of constants of the motion leading to these brackets is at least a sub-group of the complete group of constants of the motion. It has not been found possible to determine whether or not the complete group rather than a sub-group has been found. An interesting byproduct of the work is the result that it is possible to determine Poisson brackets for a theory such as this one without the introduction of canonical moments.

Microfilm $2.00; Xerox $3.00. 46 pages.

TOTAL CROSS SECTIONS FOR MULTIPLE IONIZATION IN COLLISIONS OF HELIUM, NEON, AND ARGON AT KILOVOLT ENERGIES.

(L. C. Card No. Mic 59-3839)

Phillips Russell Jones, Ph.D.
The University of Connecticut, 1959

The total cross sections for multiple ionization of a singly charged positive ion in collision with a neutral atom have been measured. The collisions of He^+ ions on helium, neon, and argon gas targets; Ne^+ ions on neon and argon; and A^+ ions on argon were studied at energies of 25, 50, and 100 kev. The processes observed ranged from electron capture (σ_{10}) to the production of seven times ionized argon (σ_{17}) and included the elastic scattering of incident ions through angles greater than one degree. In two cases where maxima were observed in the electron capture cross section measurements were made at several additional energies.

Each total cross section was determined as the sum of the contributions from the various angular regions into which the incident particle may be scattered. The contribution from the 0 to 1 degree region was measured directly while that from the regions in excess of 1 degree was obtained by integrating the measured differential cross section for the process in question. The differential measurements for the 1 to 4 degree region were made with a resolution of ± 0.2 degree and are presented separately in the text. These are an extension to small angles of previous differential measurements in the region in excess of 4 degrees, extending to 40 degrees in some cases. The relative contribution made by each of

these three regions is shown for each total cross section measured.

For each of the collisions studied the electron capture process was observed to have the largest total cross section. The total cross sections for multiple ionization were seen to decrease with increasing degree of ionization, and each of these cross sections was found to be an increasing function of incident ion energy in the 25 to 100 kev energy range. The relative contribution of large-angle scattering to the total cross section was found to increase with increasing degree of ionization.

Microfilm $2.00; Xerox $3.80. 68 pages.

DIFFRACTION OF A PLANE ELECTROMAGNETIC WAVE BY CYLINDERS WITH UNIDIRECTIONAL CONDUCTIVITY.

(L. C. Card No. Mic 59-3840)

Robert Emmett Kelly, Ph.D.
The University of Connecticut, 1959

The diffraction of a plane electromagnetic wave at oblique incidence on isotropic and hollow anisotropic cylinders of infinite length, and having unidirectional conductivity is investigated. First, a general expression for the diffracted field is derived from a combination of an electric and a magnetic Hertzian potential, and this is then subjected to the appropriate boundary conditions required on each of the cylindrical surfaces. In every case, the problem is solved for two polarizations of the incident wave: (1) transverse electric (TE), and (2) transverse magnetic (TM). In addition to the diffracted fields and their asymptotic values, the induced surface currents, the cross sections with long and short wave length limits, and the angular distribution of diffracted energy for long wave lengths are computed. For the case of the cylinder conducting only in the axial direction, it is found that an incident TE wave produces no diffracted field and that an incident TM wave results in a field identical to that of the isotropic cylinder. The diffracted field produced by cylinders restricted to conduction in circular rings i.e., the θ direction, such as a tightly wound helix, does not preserve the transverse nature of the incident plane wave polarization, in contrast to the isotropic cylinders. The surface currents induced on the θ conducting cylinders have different functional dependences according to the direction of the incident polarization. The cross section for each polarization for the isotropic cylinder at oblique incidence is simply related to the well known expression for the case of perpendicular incidence. This is also true for the axially conducting cylinder except that the cross section for an incident TE wave is zero. The cross sections for the θ conducting cylinders are very small for large wave lengths compared to the radius, but they increase as a function of the ratio of radius to wave length until a point is reached where they begin to oscillate. Plots of the cross sections vs. both angle of incidence and ratio of radius to wave length are presented. The angular distributions of the diffracted energy for all six cases (three cylinders and two polarizations) are studied, and graphs are presented comparing them for a typical angle of incidence of the incident plane wave.

Microfilm $2.00; Xerox $5.80. 119 pages.

LARGE ANGLE RADIATIVE ELECTRON SCATTERING AT 58 MEV.

(L. C. Card No. Mic 59-3953)

Peter Dowell Randolph, Ph.D.
University of Michigan, 1959

The continuum spectrum of electrons that are radiatively scattered (bremsstrahlung process) at 90 degrees is investigated experimentally for the elements aluminum, tin, and gold at an incident energy of 58 mev. The scattered electrons are magnetically momentum analyzed and measurements of the cross section for the radiatively scattered electrons are obtained as a function of the energy of the scattered electrons. The cross sections are determined by comparing the intensity of the radiatively scattered electrons with that of the electrons that are elastically scattered, the cross section for which is obtained theoretically. The computed theoretical elastic cross sections are obtained from a partial wave analysis, utilizing three phase shifts, and the effects of finite nuclear size are included using the uniform and shell models for the nuclear charge density. The experimental bremsstrahlung cross section is compared with the theoretical cross section calculated by McCormick, Keiffer and Parzen, which is based on the point charge bremsstrahlung theory of Bethe and Heitler. The experimental cross sections are found to be lower than predicted by this theory, with the discrepancy becoming larger with increasing scattered electron momentum. For a given scattered electron momentum, the disagreement also increases with atomic number. The experimental accuracy ranges from 50 percent at the low energy end of the spectrum to 20 percent at the high energy end. It is shown that to within the accuracy of the experimental data, the deviation from the Bethe-Heitler theory can be attributed principally to the effects of finite nuclear size.

Microfilm $2.00; Xerox $5.40. 108 pages.

ELECTRON DENSITY AND THERMAL EFFECTS IN α-QUARTZ.

(L. C. Card No. Mic 59-3639)

Robert A. Young, Ph.D.
Polytechnic Institute of Brooklyn, 1959

Advisers: Dr. Benjamin Post
Dr. I. Fankuchen

The positional parameters and thermal ellipsoids of α-quartz have been determined at room temperature from the three dimensional x-ray data within the (00.10) sphere. The temperature dependences of the positional parameters and the temperature factors were determined from (hk.0) data and (00.ℓ) data collected at 300°K, 223°K, and 155°K. Bond distances and angles have been calculated and bond character has been investigated briefly.

Both Fourier and least squares methods of refinement were used and electron density projections along the c-axis are presented for 300°K and for 155°K. Two difference maps, one showing the effect of temperature and the other showing the difference between observed and calculated electron density distributions are presented.

Evidence for some electron density in the Si-O bond is given by the latter difference map. The Si-O-Si bond angle is 143.9°. Some evidence of distortion of the SiO_4 tetrahedron was found.

The data of Brill, et al.[2], have been refined by the least squares methods and the results have been compared with the present results. Small but significant changes in the positional parameters from the previously reported values[2] are indicated. The best room temperature coordinate parameters and their standard deviations as determined from least squares refinement are:

Oxygen:	x = 0.4152 ± 0.0007 A	Change at 155°K:	0.0000
	y = 0.2678 ± 0.0006 A	Change at 155°K:	+0.0021
	z = 0.1184 ± 0.0004 A	Change at 155°K:	-0.0020
Silicon:	u = 0.4705 + 0.0003 A	Change at 155°K:	-0.0012

The effect of suggested, but not demonstrated, libration of the oxygen atom on the coordinate parameters is discussed. At room temperature the thermal ellipsoid of the silicon atom has its major axis in the z direction and its least axis along the two-fold crystal axis. The r.m.s. displacements along the ellipsoid axes are: 0.086 A, 0.072 A, and 0.049 A. The oxygen thermal ellipsoid orientation is slightly skew with respect to the Si-O-Si plane and the Si-O-Si angle bisector. The skewness, about 10° and 20°, amounts to 2 to 3 standard deviations. The major axis is approximately perpendicular to the Si-O-Si plane and the least axis is approximately parallel to the Si-Si line. The r.m.s. displacements along the ellipsoid axes are 0.134 A, 0.099 A, and 0.052 A.

The temperature dependence of the x-ray temperature factors was shown to be predicted within experimental error by the Debye-Waller formula.

The final R value obtained from the least squares refinement of the three dimensional data was 8%.

The care exercised in collecting, reducing, and refining the data was such that a large part of this 8% value was probably due to extinction effects. Procedures used in collecting and processing the data are discussed in detail. Microfilm $2.00; Xerox $6.80. 142 pages.

PHYSICS, ELECTRONICS AND ELECTRICITY

COUPLING OF MULTIPLE-CAVITY SYSTEMS.

(L. C. Card No. Mic 59-3677)

Matthew Arnold Allen, Ph.D.
Stanford University, 1959

Identical cavity resonators coupled together by slots of lower resonant frequency than the resonant frequencies of the uncoupled cavities are shown to be bandpass microwave filters with very large bandwidths and high impedances, so that they can form desirable circuits for use in wide-band high-power traveling-wave tubes. The particular structures which are treated here consist of cylindrical resonators coupled together by long circumferential slots in their common walls.

A theoretical treatment is developed which gives both a mathematical and a physical explanation of the observed dispersion characteristics and field distributions for these structures. The fields in the cavities are expressed in terms of the normal modes of the uncoupled cavities. Assuming a quasi-static field distribution over the narrow face of a slot, the field in the neighborhood of a slot is determined by representing the slot as a transmission line with current sources placed along its length. Expressions are derived from which the properties of the coupled systems may be determined. Irrotational components of the field account for direct slot-to-slot coupling. The method successfully predicts both the dispersion characteristics and the field distributions over large frequency ranges for many practical systems.

A lumped circuit equivalent is obtained for the coupled system. The lumped elements are directly related to the properties of the cavities and the slots. A discussion of the limitations of the equivalent-circuit approach is given.

In order to obtain the most suitable traveling-wave-tube circuits from the long-slot coupled structures, certain modifications which alter the passbands' shapes have to be incorporated into these structures. These modifications are discussed and suitable circuits are presented. Microfilm $2.30; Xerox $8.00. 174 pages.

ON THE BOUNDARY VALUE PROBLEM OF WAVEGUIDE WINDOWS.

(L. C. Card No. Mic 59-3700)

Max Paul Forrer, Ph.D.
Stanford University, 1959

The mode conversion theory developed by Ayres and Jaynes is generalized to the case of arbitrary dielectric obstacles, and applied to the problem of the vicinity of dielectric waveguide windows of general shape. Results are compared with experimental measurements, wherever practical, to determine the validity of the approximate methods used. The mathematical method is that of a normal mode expansion of the electromagnetic fields. The contribution of individual waveguide modes to the total field may be determined by successive approximations. The theory is applied to several specific window geometries (transverse slab, stepped window, slanted dielectric sheets and ceramic cone), where a perturbation procedure is used, based on an expansion of the fields in powers of $(\varepsilon - 1)$. The comparison between theory and experiment is usually done by way of the reflection coefficient. First-order solutions are accurate for windows of low dielectric constant ($\varepsilon < 4$) and small length. Improvements obtainable by second-order approximation are illustrated in one example. For windows of high dielectric constant ($\varepsilon \approx 10$) and a length of the order of a guide wavelength, there is strong modal interaction, so that the first-order solutions are only qualitatively correct. Accurate results for this case must be obtained by numerical integration of the coupled differential equations of several modes. This problem is well adapted to programming on a computer.

The phenomenon of ghost-modes in dielectric windows is discussed. For the case of transverse slab windows, the resonant frequencies are computed, and the results are represented through universal curves and verified by experiment. Possible connections between ghost-modes and window breakdown are discussed.

Microfilm $2.00; Xerox $6.00. 124 pages.

PHYSICS, NUCLEAR

FAST PHOTONEUTRONS FROM TANTALUM AND GOLD.

(L. C. Card No. Mic 59-4211)

Luther Bachman Aull, III, Ph.D.
University of Virginia, 1959

The yield of neutrons from tantalum and gold with energies above the $Si^{28}(n,p)Al^{28}$ threshold was determined as a function of the maximum bremsstrahlung energy using the University of Virginia synchrotron. Yield measurements were taken at one Mev intervals in the energy range 18 to 30 Mev and at two Mev intervals from 30 Mev to 64 Mev. Silicon powder packed between two thin wall concentric lucite cylinders was used as a neutron detector. A one inch diameter cylindrical sample of tantalum or gold and the two inch diameter detector were mounted coaxially with the beam. The residual Al^{28} activity was measured with a manifold of three Geiger counters. Cu^{62} activity produced in thin copper disks mounted in the same beam with the sample gave a measurement of the beam intensity. The integrated cross section, to 60 Mev, as determined by the method of Leiss and Penfold,[1] is approximately 800 mb-Mev for both tantalum and gold. At 30 Mev the integrated fast photoneutron cross section represents about 5% to 10% of the total photoneutron integrated cross section.[2] Measurements are compared with the theoretical predictions of several phenomenological models of the nucleus. Microfilm $2.00; Xerox $4.60. 90 pages.

1. A. S. Penfold and J. E. Leiss, "Analysis of Photo Cross Sections," University of Illinois, (1958).

2. L. W. Jones and K. M. Terwilliger, Phy. Rev. 91, 699, (1952).

SCATTERING OF 2- TO 4- MEV POLARIZED NEUTRONS BY CARBON.

(L. C. Card No. Mic 59-4213)

William Bennett Beverly, Ph.D.
University of Virginia, 1959

C^{12} has been frequently used as a neutron polarization analyser[1,2] but no attempt has been made to measure the polarization as a function of neutron energy. However, the differential cross section for elastic scattering of medium energy neutrons has been measured by several groups[1,3] and the polarization as expected from their phase shifts has been computed. These measurements have led to the assignment of definite parameters to the C^{13} levels responsible for the first three resonances. These levels occur at neutron bombarding energies of 2.076-, 2.95-, and 3.67-Mev with respective parameters of $D_{5/2}$ with a 7-Kev width, $D_{3/2}$ with a 90-Kev width, and $D_{3/2}$ with a 1.69-Mev width.

In this experiment, we undertook to study experimentally the polarization induced in neutrons in the 2-4 Mev energy range by scattering the neutrons from Carbon at 45^0 center of mass. This was accomplished by using the polarized neutrons from the $D(d,n)He^3$ reaction and measuring the right-left asymmetry in the scattered beam. Neutrons of different energies in this range were obtained by using thin heavy ice targets and adjusting the deuteron energy and angle of neutron emission.

These measured values were compared with the polarization as predicted by the phase shifts of Meier, et al[1] and Wills, et al.[3] Our measured values were somewhat greater than those predicted by either group but best agreement seemed to be with Meier.

Microfilm $2.00; Xerox $3.00. 57 pages.

1. Meier, Scherrer and Trumpy, Helvetica Physica Acta 27 (1954) 577.

2. B. M. McCormac, M. F. Steuer, C. D. Bond and F. L. Hereford, Physical Review 104 (1956) 718.

3. J. E. Wills, Jr., J. K. Bair, H. O. Cohn and H. B. Willard, Physical Review 109 (1958) 891.

POLARIZATION OF 2-4 MEV NEUTRONS SCATTERED BY DEUTERONS.

(L. C. Card No. Mic 59-4215)

William Paul Bucher, Ph.D.
University of Virginia, 1959

The left-right asymmetry in the scattering of D-D neutrons by deuterons has been measured for various scattering angles and incident neutron energies. The polarization of the deuteron scatterer (i.e., the neutron polarization produced by scattering unpolarized neutrons) was then inferred from this measured asymmetry and the experimental values of the D-D neutron polarization as summarized by Pasma.[1]

A liquid scintillator (C_6D_6) was used as the scatterer to allow detection of the deuteron recoils. The left-right asymmetry was measured in the same plane in which the $d(d,n)He^3$ took place by two suitably placed stilbene crystals which simultaneously detected the neutrons scattered to the right and left. Only those pulses from the right and left detectors were counted which were in time coincidence with the deuteron recoils and fell within a selected pulse height interval, this interval being dependent upon the energy of the neutrons after scattering.

A magnetically analyzed beam of nearly monoenergetic deuterons produced by a 1 Mev Van de Graaff accelerator was used in conjunction with heavy ice targets to produce the partially polarized neutrons. Both thick and thin targets were employed. The target thickness was determined by two independent methods: (1) the well known

resonance-shift method, and (2) by comparison of thin and thick yields.

Using the above method, very small polarization effects have been obtained. This is in disagreement with the large polarization values reported by White et al;[2] but, however, is consistent with the experimental results in references (3), (4), and (5). Further, two recent theoretical treatments[2,6] predict that only small (6% at most) polarization effects should be observed in the 2-4 Mev region. Microfilm $2.00; Xerox $3.00. 48 pages.

1. P. J. Pasma, Nuc. Phys., 6 (1958) 141.
2. R. E. White, A. Chisholm, and D. Brown, Nuc. Phys., 7 (1958) 233.
3. M. Brullmann, H. J. Gerber, and D. Meier, Helv. Phys. Acta. 31 (1958) 318.
4. H. J. Gerber, M. Brullmann and D. Meier, Helv. Phys. Acta. 31 (1958) 580.
5. L. Cranberg, Phy. Rev. Letters, 2 (1959) 324.
6. R. S. Christian and J. L. Gammel, Phys. Rev., 91 (1953) 100.

A PRECISE MEASUREMENT OF THE MAGNETIC MOMENT OF THE TRITON IN UNITS OF THE MAGNETIC MOMENT OF THE PROTON.

(L. C. Card No. Mic 59-3695)

William Thomas Duffy, Jr., Ph.D.
Stanford University, 1959

High resolution magnetic resonance techniques were used to perform a precise measurement of the ratio of the Larmor frequency of the triton to that of the proton in a sample of 20% tritiated water. This ratio was found to be 1.06663975 (2). The relative magnetic shielding of tritons and protons in water is estimated to be one part in 10^7. From the measured frequency ratio and this estimate of the magnetic shielding correction, a value of 1.06663986 (11) is obtained for the triton magnetic moment in units of the proton moment. From this value, the known reduced masses of the electron in tritium and hydrogen, and the hfs measurements of Kusch, and Prodell and Kusch, one obtains a hfs anomaly of $(-5.62 \pm 0.13) \times 10^{-6}$ for tritium. This observed anomaly is compared with the theoretical predictions of Adams. The longitudinal relaxation times, T_1, of the protons and tritons in the tritiated water were measured and found to be 1.02 ± 0.10 seconds and 0.83 ± 0.10 second respectively.

Microfilm $2.00; Xerox $3.80. 66 pages.

SEARCH FOR EXTRANUCLEAR EFFECTS ON GAMMA-GAMMA ANGULAR CORRELATION IN THE DECAY OF Co^{60} AND In^{114}.

(L. C. Card No. Mic 59-3876)

Arthur G. Duneer, Jr., Ph.D.
Rensselaer Polytechnic Institute, 1959

Supervisor: William A. McKinley

An investigation was made of the effect of different atomic environments upon the angular correlation of gamma-gamma cascades which result from the decay of the nuclides Co^{60} and In^{114}. A review is given of previous work on Co^{60}, In^{114}, and In^{111}. The last is discussed because of the relationship of some of the present work to earlier studies made of the decay of In^{111}, especially where the source was contained in single crystals of indium.

The anisotropy of radiation of a gamma-gamma cascade is defined as $A = \frac{W(180^0)}{W(90^0)} - 1$ where $W(180^0)$ is the relative probability of the two cascaded gamma rays being emitted in opposite directions, and $W(90^0)$ is the relative probability that the gamma rays will be emitted at right angles to each other. Experimental measurements have been performed of this anisotropy of the gamma-gamma cascade from the decay of Co^{60} when the cobalt is combined in various chemical forms. The equipment consists of a combination of slow and fast coincidence channels so that a resolving time of twenty milli-microseconds could be obtained and pulse height discrimination could also be employed. The experimental values of the anisotropies are as follows:

Compound	Anisotropy
Liquid $Co^{60}Cl_2$	$0.1658 \pm .0049$
Solid $Co^{60}(OH)_2$	$0.1705 \pm .0049$
Solid $Co^{60}Cl_2$	$0.1635 \pm .0043$

These results are all within the experimental standard deviations of the theoretical value for the anisotropy ($A = 0.1667$) of the unperturbed nucleus. The upper bound on the quadrupole moment of the intermediate excited state was found to be $5.8 \times 10^{-23} cm^2$ when 10^{19} volts/cm^2 was taken as the electric field gradient at the nucleus.

A metallic indium single crystal containing In^{114} was prepared and an experiment carried out to determine whether the interaction between the extra-nuclear electric field gradient and the electric quadrupole moment of the Cd^{114} daughter nucleus is great enough to affect the angular correlation of the gamma rays in the K-capture branch of the decay. It was found that the angular correlation was not perturbed within the experimental standard deviation of the experiment, about 0.4% for each of the observations at six different orientations of the indium crystal. By making mathematical estimates of the electric field gradient, the quadrupole moment of the intermediate excited state of Cd^{114} is determined to be less than $5.6 \times 10^{-22} cm^2$.

Microfilm $2.00; Xerox $5.20. 103 pages.

A THEORETICAL STUDY OF THE DECAY OF HYPERTRITIUM.

(L. C. Card No. Mic 59-4109)

Clarence Gerald Gardner, Ph.D.
Vanderbilt University, 1959

Supervisor: Professor W. G. Holladay

The ratio of the rates of the two modes of decay of hypertritium leading respectively to He^3 and to H^2 has been calculated from two broad points of view. In the first case, a very open structure for hypertritium was assumed. The effects of the exclusion principle in the final state of the H^2 decay mode were neglected, as were all final state interactions among unbound constituents. The decay of hypertritium was assumed to be due to the same interaction responsible for the decay of the free lambda hyperon; a nonrelativistic, parity nonconserving interaction was assumed for the decay of the lambda hyperon. In the second case, a compact structure was assumed for hypertritium, and the effects of the exclusion principle in the H^2 final state was explicitly taken into account, though final state interactions were again neglected. In each of the preceding two cases, the calculation was carried out for each of the two a priori possible spin choices for hypertritium, i.e., 1/2 and 3/2.

The loose structure approximation led to a prediction of the ratio of He^3 events to H^2 events much below the tentative experimental value of unity.

This was seen to be essentially a geometrical effect, reflecting the large separation of the lambda hyperon from the remaining constituents of hypertritium. The 1/2 choice for the spin led to a higher value for the ratio than did the 3/2 choice.

The compact structure approximation was found to be capable of leading to values for the He^3/H^2 ratio equal to or larger than one. It was shown that the effects of the exclusion principle were material when the ratio assumed these values. However, the ratio was not sufficiently sensitive to the spin choice to warrent a definite conclusion as to the spin of hypertritium.

It was noted that, if the present experimental value of the ratio of He^3 to H^2 events persists, something of a problem will exist in reconciling the low binding energy of hypertritium with its extraordinarily compact structure.

Microfilm $2.00; Xerox $5.20. 102 pages.

INTERACTIONS OF 15 MEV NEUTRONS WITH NUCLEI.

(L. C. Card No. Mic 59-4223)

Byron Clark Groseclose, Ph.D.
University of Virginia, 1959

Angular distributions of 15 Mev neutrons elastically scattered by many elements have been measured. The neutrons were produced by the bombardment of tritium with deuterons. They were electronically collimated by requiring coincidences in a fast coincidence circuit (resolving time of 3 millimicroseconds) between the scattered neutrons and the associated recoil alpha particles.

The experimental results include angular distributions (up to 130^0 for most elements) of 15 Mev neutrons elastically scattered by Li, O, Mg, Al, Ni, Cu, Zn, Mo, Sn, Pb, and Bi. These results have been compared with the theoretical optical model predictions of Bjorklund and Fernbach. The optical potential used included a Woods-Saxon real part, a Gaussian imaginary part on the nuclear surface, and a spin-orbit term to dampen the large angle oscillations. The agreement of the data with the theoretical curves is very good. Since the distributions do not show deep minima in the backward hemisphere, the inclusion of the spin-orbit term in the potential is necessary.

For magnesium and nickel, angular distributions were also measured at 14 Mev. This was done to investigate possible anomalous changes of differential cross section with energy; such changes have been reported by several investigators for proton scattering from magnesium. No unusual changes were found in the angular distributions for neutrons between 14 and 15 Mev.

A detector system which can be used to measure angular distributions of deuterons from (n,d) reactions with 15 Mev neutrons has been constructed and tested. The preliminary results indicate that the system can be used in such reactions but some changes in design are necessary to obtain optimum performance.

Microfilm $2.00; Xerox $6.40. 135 pages.

A 60 MEV ELECTRON SCATTERING MEASUREMENT OF THE NUCLEAR RADII OF ALUMINUM, COPPER, AND TUNGSTEN.

(L. C. Card No. Mic 59-3946)

Daniel Allan Naymik, Ph.D.
University of Michigan, 1959

In this experiment electrons which have been accelerated to an energy of 60 mev are scattered from target wires of aluminum, copper, and tungsten, into an electron detection system composed of collimating slits, an analyzer magnet, and a Cerenkov counter. This system is movable so that it can be placed at each of seven scattering angles. The collimating slits define a solid angle for giving practical counting rates, the analyzer magnet allows only elastically scattered electrons to be counted, and the Cerenkov counter is sensitive to high energy electrons only.

The intensity of the beam is not measured directly; instead, a number which is proportional to the intensity is measured by means of a second, stationary electron detection system which "monitors" the beam intensity while counting measurements are being made with the movable detection system. Because the intensity is not a directly measured quantity, the data must be fitted to the scattering cross section relative to a fixed and arbitrary scattering angle.

By assuming a spherically symmetric distribution of nuclear charge one can determine a solution to the Dirac equation for an elastic scattering problem in which the energy of the electrons colliding with a nucleus of Z protons and A nucleons is large compared to the rest mass of the electron. This solution is specifically called the elastic scattering cross section and is a measure of

the probability that an electron be scattered through an angle if it collides with a nucleus. The solution was obtained by using an IBM 650 computer to calculate the phase shift for the first three partial waves. For a fixed number of scattering nuclei the number of electrons actually scattered through a given angle is proportional to the scattering cross section, to the solid angle subtended by the electron detection system, and to the intensity of the incident beam of electrons. The nuclear radius of a given target nucleus is determined by fitting the experimental data to the theoretical computations. The theoretical curve which best fits the experimental data corresponds to a particular value of the parameter characterizing the family of scattering cross section curves. This parameter can be directly related to the nuclear radius.

The results of this experiment show that the nuclear radii of aluminum, copper, and tungsten are 1.41 - .07, 1.15 - .06, and 1.14 - .06 fermis (one fermi equals 10^{-13} cm), respectively. These measurements are in good agreement with other electron scattering measurements. However, mirror nuclei measurements of the radius of the aluminum nucleus do not agree with the results of this experiment. Microfilm $2.00; Xerox $4.60. 87 pages.

THE NUCLEAR STATES IN THE RaE β-DECAY.

(L. C. Card No. Mic 59-4029)

Neal Dow Newby Jr., Ph.D.
Indiana University, 1959

It is shown that the β-transforming neutron of Bi^{210} most probably has an $i_{11/2}$ character despite a $g_{9/2}$ character for the ground state neutron in Pb^{209}. This makes a critical difference to the RaE spectrum parameter $\xi = i\langle r\rangle / \langle \underline{\sigma} \times \underline{\nu} \rangle$ yielding $\xi \approx +1$ rather than $\xi \approx -1/10$ The effect of configuration mixing is also investigated but does not affect ξ appreciably.

To arrive at the above conclusions it is necessary to show that the neutron-proton attraction in the $(h_{9/2}\ i_{11/2})_1$ state is the large amount 840 Kev greater than in the $(h_{9/2}\ g_{9/2})_0$ state. The resulting shell-model problem has interest independent of the β-theory application which was the primary objective of this work. True and Ford had found that two neutrons extra to the doubly-magic Pb^{208} core, as against nucleons deep in the core matter, interact with about the same strength and range of force as do two free nucleons. The problem here checks the extension of that important finding to neutron-proton and proton-proton pairs. The force strength is consequently not used as an adjustable parameter as it has been in previous approaches to such problems.

The True-Ford problem involved only singlet, central forces between like nucleons in an essential way. The RaE daughter, Po^{210}, investigated here, has only coulomb repulsion superposed. The resultant comparison with experiment is about as good as that obtained by True and Ford.

The extension to the neutron-proton pair of Bi^{210} is far more complex since triplet forces, an exchange character, and non-central forces may come into play. We find that the finite-range central forces alone cannot give substantially more attraction in the $(h_{9/2}\ i_{11/2})_1$ state than in the $(h_{9/2}\ g_{9/2})_0$ state. Using the strength as a parameter cannot help significantly. However, tensor forces produce attraction in the former and repulsion in the latter state. Hence, the two-body forces must be imitated even in this detail in order to yield an explanation of the RaE level scheme. This is unfortunate for quantitative results because the strength of the two-body tensor force seems never to have been determined unambiguously for potentials without cores.

In Bi^{210}, due to a fortuitous cancellation, a finite range central plus finite range tensor interaction recovers the agreement found with a zero range force -- namely that the relative positions of the J = 0 and 1 states turn out in almost perfect agreement with observations. Configuration mixing plays a role in this result and, in consequence, the work includes a generalization of DeShalit's formulas, for the interaction energies with 0-range forces, to non-diagonal matrix elements.

Microfilm $2.00; Xerox $4.20. 76 pages.

A STUDY OF THE GAMMA RAY AND INNER BREMSSTRAHLUNG TRANSITIONS IN THE DECAY OF SN-113.

(L. C. Card No. Mic 59-4117)

Willie Edward Phillips, Ph.D.
Vanderbilt University, 1959

Supervisor: Professor John I. Hopkins

A fast-slow coincidence spectrometer was used to study the decay of Sn-113. A 650-kev gamma ray was found in the single-channel spectrum and it was found to be in coincidence with the In K X-ray in the fast and in the slow coincidence spectra. This confirmed the existence of a 650-kev level in In-113 fed by a weak orbital capture branching.

From the relative intensities of the 257-kev gamma rays and of the 650-kev gamma rays ($16.4 \pm 1.9 : 1$), it was determined that the spin of the 650-kev level is 5/2 and the parity is odd.

This assignment was confirmed by the K-conversion coefficient of the 257-kev transition which was computed from experimental data as 0.068 ± 0.029 which indicates an electric quadrupole transition, but not unambiguously.

The existence of the 650-kev In-113 level and of captures to it indicates that the ground level of Sn-113 lies more than 257 kev above the first excited level at 393 kev. The absence in the literature of detected positron emission indicates that the Sn-113 level lies below or near the positron threshold of 1.02 Mev above the 393-kev level. By means of log(ft) classifications, the capture energy for allowed transitions was computed to be 50 to 120 kev; for first forbidden transitions, 400 to 1200 kev; for unique first forbidden transitions, 2 to 8 Mev; and for higher order transitions, greater than 8 Mev. Therefore, a first forbidden transition ($\Delta L = 1$;

$\Delta I = 0, \pm 1$) was indicated. Therefore, the ground level of Sn-113 is $s_{\frac{1}{2}}$ or $d_{3/2}$ (or $D_{3/2}$). If it is $s_{\frac{1}{2}}$, decays to the $f_{5/2}$ level of the intensity observed would require that Sn-113 lie more than 1.3 Mev above this level of 1.5 Mev above the $p_{\frac{1}{2}}$ level. The absence of positrons refutes this; therefore, the Sn-113 ground level has spin 3/2 and even parity. The possibility of the presence of both levels closely spaced is merely acknowledged.

An inner bremsstrahlung spectrum was taken in the energy range above the 393-kev gamma peak. The spectrum was corrected only for counter dead-time and for background and was compared with the spectra to be expected experimentally as were determined by correcting the theoretical $x(1-x)^2$ shape for relativistic effects, photopeak efficiencies, compton distribution, iodine-X-ray escape, crystal resolution, and crystal housing absorption at various end-point energies. The experimental shape indicated a probable end-point energy of 900 $\pm$ 300 kev. The observed intensity was appropriate for radiation accompanying orbital electron capture from the ground level of Sn-113 to the first excited level of In-113, but the lack of knowledge of K- to L-capture ratios prevented a quantitative use of the intensity. The indicated decay energy of the Sn-113 decay was 1.3 $\pm$ 0.3 Mev which was consistent with the decay energy of 1.35 $\pm$ 0.25 Mev computed from mass data and was consistent with the 0.8 to 1.6 Mev range determined for a first forbidden transition to the first excited level.

Microfilm $2.00; Xerox $3.00. 51 pages.

POSITRON-ELECTRON SCATTERING AT 200 MEV.

(L. C. Card No. Mic 59-3718)

John Anthony Poirier, Ph.D.
Stanford University, 1959

A beryllium target 2.00-g/cm^2 thick was bombarded by 199-Mev positrons. A diffusion cloud chamber was located immediately behind the target and was used to detect recoil electrons from positron-electron scattering events. The cloud chamber was located in a vertical magnetic field of 5-1/2 kilogauss which permitted the momentum of the recoil electrons to be measured to 1-1/2% relative to the incident positron momentum. The number of incident positrons was determined by counting the number of positron tracks in the chamber; in 10,298 cloud-chamber pictures the total incident flux was $(0.456 \pm 0.007) \times 10^6$ positrons.

The corrected experimental yield of electrons in the energy interval from 87.5 to 200 Mev was 216^{+18}_{-17}. The expected yield on the basis of Bhabha's theory, corrected for experimental details, is 243 electrons. If the deviation of this experiment from theory is to be ascribed to radiative corrections, the measured correction to the Bhabha cross section (averaged over this electron energy interval) is $(-11.0^{+7.5}_{-6.9})\%$.

An analysis of the energy distribution of 100 recoil electrons is quite consistent with the complete Bhabha theory, and is inconsistent with the Bhabha theory minus annihilation terms. A quantitative measure of this agreement is given by Pearson's χ^2 test which yields a probability that if the observations were repeated, greater statistical deviations from the true distribution would be obtained than those that were observed. If the true distribution is the complete Bhabha theory, the probability is $0.50^{+0.12}_{-0.17}$; if the Bhabha theory without annihilation terms, 0.02. Microfilm $2.00; Xerox $5.40. 110 pages.

ELASTIC SCATTERING OF 14 MEV NEUTRONS AND DEVELOPMENT OF A DIRECTIONAL NEUTRON COUNTER.

(L. C. Card No. Mic 59-4247)

Robert Franklin Stetson, Ph.D.
University of Virginia, 1959

Considerable interest in the optical model for nuclear scattering has created a need for better experimental data on neutron scattering. For this reason the relative differential cross sections of 14-15 Mev neutrons elastically scattered by Bi, Pb, Sn, Mo, Zn, Cu, Ni, Al, Mg, O, and Li have been measured for angles up to 160° lab. The experimental data were compared with and used along with data from other laboratories to obtain the parameters for the potential employed by Bjorklund to predict cross sections for neutron reactions. The potential as used by Bjorklund includes a diffuse-boundary, real, central well (V_{CR} = 44 Mev), an imaginary term in the form of a Gaussian peaked at the nuclear surface (V_{CI} = 11 Mev), and a spin-orbit term (V_{SR} = 8.3 Mev), for 14 Mev neutrons. The agreement with theory is excellent and demonstrates the validity of the potential.

A 1 Mev Van de Graaff was used to provide deuterons for the H^2 (d,n) He^4 reaction. The He^4 was detected with a 5-mil thick plastic scintillator, 1 cm x 2 cm, mounted on an RCA 6342 photomultiplier, which closed the vacuum system. The alpha pulse was used along with the neutron pulse, also detected with a plastic scintillator, 2x4x5 cm, and photomultiplier, after pulse shaping as the input to a fast coincidence circuit of resolving time 3×10^{-9} sec. The neutron beam was thus collimated electronically. The output of the coincidence circuit was used to gate on a 20-channel analyzer on which the neutron spectrum was displayed. The data were then analyzed to exclude inelastic events.

The angular distributions of neutrons scattered by Mg and Ni were done at both 14 and 15 Mev in an effort to search for possible anomalous energy variations in the angular distributions. No such variations were found and the distributions agreed with the predicted curves.

In an effort to improve further the neutron data, the forward-peaked angular distribution of recoil protons from an n-p collision was used in the construction of a directional neutron scintillator. Three models of this type were constructed using 1 mm and 2 mm plastic scintillator filaments separated by Nujol. As high as 1000:1 has been obtained for the ratio of axial counting rate to broadside counting rate with 14 Mev neutrons, depending on the integral bias setting of the scaler.

Absolute efficiencies are of the order of 0.2% for 14 Mev neutrons. All the data agree with the predictions based on a rough calculation.

Microfilm $2.00; Xerox $5.80. 117 pages.

SOME GENERAL PROPERTIES OF NUCLEAR REACTION CROSS-SECTIONS AND LEVEL WIDTHS.

(L. C. Card No. Mic 59-858)

Theodor Teichmann, Ph.D.
Princeton University, 1949

Abstract not available.

Microfilm $2.00; Xerox $7.00. 146 pages.

PION STATISTICS AND SCATTERING: A STUDY OF TAU MESON DECAY.

(L. C. Card No. Mic 59-4119)

Billy Seay Thomas, Ph.D.
Vanderbilt University, 1959

Supervisor: Professor W. G. Holladay

By analyzing the decay of the tau meson, evidence for the Boson character of positive pions is obtained which is independent of the Pauli theorem that integral (half-integral) spin particles must obey Bose (Fermi) statistics. It is important to verify the Pauli theorem for each type of elementary particle because of the fundamental nature of the postulates required to prove the theorem. Any evidence that some type of particle does not obey the statistical law required by the Pauli theorem would call the validity of the Pauli postulates or the present form of field theory into question.

The method of analysis used is an adaptation of the procedure of Dalitz and Fabri of expanding the transition matrix element in a double series of angular momentum eigenfunctions of the final state pions. It is found that the predicted pion distributions depend, not only on the assumed spin and parity of the initial state tau meson, but also on whether the pions are bosons or fermions. The assumption that positive pions are fermions is incorporated by taking the final state wave function to be antisymmetric with respect to interchange of positive pions. The negative-pion energy and angular distributions are calculated, on the basis of this assumption, for all spin and parity combinations up through spin three. It is shown that none of the distributions agrees with the data nearly so well as the distribution obtained by assuming a pseudoscalar tau meson and pions which are bosons. The criterion of agreement used is the statistical quantity χ^2, and the result obtained is that the χ^2 probability of each of the hypotheses' being the correct one (an hypothesis consists in the fermion assumption, plus an assumed spin and parity of the tau meson) is much less than 0.1%, whereas an hypothesis is ordinarily discarded if the χ^2 probability of its correctness is less than 1%.

As it is now known that parity is not always conserved in weak interactions, an attempt is made to fit the data by relaxing the requirement that parity be conserved in the decay. Again no agreement is found if the tau spin is less than three. It is concluded that, if parity is (is not) conserved in the decay, then pions are bosons if the tau spin is less than four (three). The conclusions do not depend on invariance under time reversal or charge conjugation, for no assumption is made about the relative phases of the different terms in the matrix elements.

Although the assumption that pions are bosons produces much better agreement between the experimental and theoretical distributions than any hypothesis which includes the fermion assumption, the agreement is not perfect, since the theory predicts that the probability of (negative) pion emission is independent of pion energy, while the data show that this probability is an increasing function of energy. Accordingly, the conclusion that pions are bosons is accepted, and it is shown that the remaining discrepancy between the data and the hypothesis of a pseudoscalar tau meson can be explained by assuming that the positive pions scatter through a short range interaction of strength such that the scattering length is one pion Compton wavelength. It is further shown that, if each pion interacts with both the other two, the value of $\frac{1}{4}$ barns which was obtained for the zero energy scattering cross section is a lower limit to the true cross section. Microfilm $2.00; Xerox $5.40. 106 pages.

ELASTIC AND INELASTIC NEUTRON SCATTERING USING TIME OF FLIGHT TECHNIQUES.

(L. C. Card No. Mic 59-4248)

William Waldrum Walker, Ph.D.
University of Virginia, 1959

Experimental investigations of elastically and inelastically scattered neutrons have been made using incident neutrons in the 14 to 15 Mev range. Elastic scattering of both 14 and 15 Mev neutrons from magnesium and nickel has been studied in order to investigate the possibility that their angular distributions might exhibit rapid variations with energy such as have been observed for protons elastically scattered from magnesium. The data indicate that no such variation occurs for the neutron energies employed. Angular distributions of elastically scattered 15 Mev neutrons from oxygen and lithium have also been measured and compared with theoretical curves which were obtained from optical model calculations by Bjorklund.

A time to pulse height converter of Green and Bell design has been built and used with the associated particle time of flight technique for measuring the angular distribution of the inelastic scattering of 15 Mev neutrons from the 4.43 Mev level in carbon over the angular range from 29° to 86°. Absolute values of the differential cross section were determined by comparison with the elastic distribution. The differential cross section was found to be peaked in the forward direction. Preliminary data for inelastic neutron scattering from oxygen have also been obtained.

As a further application of the time to pulse height converter, positron lifetimes in water and ice have been measured as a function of temperature with particular emphasis on the water-ice phase transition. Values of the mean life of the long-lived component (τ_2) were obtained over a range of temperatures from -165° C to +65° C. A change in τ_2 at the 0° C phase transition was observed. τ_2 which was found to have the approximately constant value of 1.5 ± 0.2 mμsec in water decreased to 0.8 ± 0.2 mμsec in ice. For the water-ice transition the intensity of the τ_2 component increased.

Microfilm $2.00; Xerox $6.40. 134 pages.

THE MODERATION AND ABSORPTION OF NEGATIVE PI MESONS IN HYDROGEN.

(L. C. Card No. Mic 59-859)

Arthur Strong Wightman, Ph.D.
Princeton University, 1949

The absorption of negative pi-mesons by hydrogen nuclei can yield decisive information on the character of the mesons as well as their coupling to nucleons, provided an appreciable fraction of the mesons are absorbed before decaying.

In the first half of this thesis it is shown that in liquid hydrogen negative pi mesons will be moderated to a K orbit around a hydrogen nucleus in less than 10^{-11} seconds on the average. Furthermore, less than 10% of the mesons may be expected to decay in flight.

In the second half of this thesis the probability of absorption by the proton is discussed. The absorption reactions are assumed to be

$$\pi^- + p \rightarrow n + \gamma$$

or

$$\pi^- + p \rightarrow n + \pi^0$$

An experimental determination of the products of π^- meson absorption can determine whether the π^- meson has integer or half odd integer spin. Under favorable circumstances further information on the character of the π^- meson can be derived.

Microfilm $3.15; Xerox $10.80. 241 pages.

PROTON PROTON SCATTERING AT 10 AND 68 MEV.

(L. C. Card No. Mic 59-3773)

Donald Edward Young, Ph.D.
University of Minnesota, 1959

Major Adviser: Lawrence H. Johnston

Differential cross sections have been measured for the scattering of 9.69 and 68.3 Mev protons by hydrogen gas, covering the laboratory angular range from 5° to 50°. The protons are accelerated by the Minnesota Proton Linear Accelerator[1] and the scattering occurs in a specially designed small angle scattering chamber.[2] The scattered protons are selected by two detector telescopes and detected by means of a single thick sodium-iodide scintillating crystal. One detector telescope covers the angular range from 4° to 20° (laboratory) with an angular resolution of ± 1/2°; the other covers the angular range from 10° to 60° with an angular resolution of ± 2°. The proton beam passing through the chamber is measured by collecting the unscattered protons in a beam collector cup connected to a capacitor beam current integrator.

In the 9.69 Mev experiment, the hydrogen scattering gas flows continuously through the chamber and is regulated at one-quarter atmosphere by means of a specially designed pressure-regulating valve. The hydrogen is purified by a palladium filter. Measurements were made at 26 angles between 10° and 90.1° (center-of-mass) with an estimated accuracy of ± 0.7% absolute and ± 0.5% relative except at angles of 10°, 12°, and 14° where the errors are larger. The differential cross section (center-of-mass) goes through a minimum at 36° with a value of 51.0 millibarns per steradian and then rises to a value 54.4 at 90°. Significant departure from pure S-wave scattering is evident.

In the 68.3 Mev experiment, purified hydrogen gas at one atmosphere pressure is used as the scatterer. Measurements were made at 26 angles from 10.18° to 101.01° (center-of-mass) with an estimated accuracy of ± 0.9% absolute and ± 0.5% relative except at the smallest angles where the errors are larger. The differential cross section (center-of-mass) goes through a minimum at 16.28° of 5.19 millibarns per steradian, then rises to a maximum value of 6.34 between 34.58° and 60.89°, and then falls off to a constant value of 6.16 between 74.98° and 101.01°. Microfilm $2.00; Xerox $5.80. 120 pages.

1. Day, Featherstone, Johnston, Lampi, Tucker, and Williams, Rev. Sci. Inst. 29, 457 (1958).
2. Johnston and Swenson, Phys. Rev. 111, 212 (1958).

PHYSICS, SOLID STATE

IMPURITY EFFECTS ON THE SUPERCONDUCTIVE CRITICAL TEMPERATURE OF INDIUM AND ALUMINUM.

(L. C. Card No. Mic 59-3569)

Gerald Chanin, Ph.D.
Rutgers University, 1959

Major Professor: Bernard Serin

We find that the effects of 0.01 to 1.0 atomic per cent of various impurities on the superconductive critical temperature of indium and aluminum are strikingly similar to those previously reported for tin. For sufficiently small amounts of all solutes there is an electronic mean free path effect on the critical temperature such that T_c decreases linearly with increasing reciprocal free path. For larger impurity concentrations the curves of critical temperature vs concentration fall into

groups according to the valence difference between solvent and solute. T_c has a sharp upward trend for higher valence solutes; for those with lower valence the curves of T_c tend to flatten out. The similarity of these impurity effects for three such different superconductors suggests that they are a fundamental property independent of the detailed nature of the superconductor.

Microfilm $2.00; Xerox $3.00. 39 pages.

THE THERMOELECTRIC POWER OF COPPER ALLOYS.

(L. C. Card No. Mic 59-2636)

Richard Henry Kropschot, Ph.D.
Michigan State University, 1959

The following alloys - CuZn, CuGe, CuCd, CuIn, CuSn, CuSb - were prepared by melting the components in vacuum. All alloys contained approximately 99 percent copper. The Thermoelectric powers of these copper alloys relative to pure copper have been measured over the temperature range 4.2°K to 340°K. Measurements were made on severely cold worked samples before and following annealing at elevated temperatures. The residual resistivities of these same alloys were also determined. Over the temperature range 40°K to 340°K the thermoelectric power of the annealed copper alloys against pure copper agrees with the theory of Friedel only if one assumes, in addition to the electronic thermoelectric power, a contribution due to phonon drag. Below 40°K the large changes and sign reversals in the thermoelectric power of the alloys relative to pure copper are due to an anomalous behavior of the pure copper. Attempts to explain the behavior of pure Cu at low temperatures have not been successful. The internal consistency of the data and their analysis above 40°K lends strong support to the validity of the assumptions that were made, particularly those concerning the existence and magnitude of the phonon-drag contribution. The work reported herein provides, therefore, the first experimental indication of a phonon-drag effect in copper. Data on some silver alloys is also presented.

Microfilm $2.15; Xerox $7.60. 164 pages.

AN INVESTIGATION OF ENHANCED NUCLEAR POLARIZATIONS IN SOLIDS AT LOW TEMPERATURE.

(L. C. Card No. Mic 59-3610)

Robert Howard Webb, Ph.D.
Rutgers University, 1959

Major Professors: H. C. Torrey and R. T. Weidner

Nuclear polarizations enhanced by two paramagnetic resonance techniques were investigated. The Abragam effect - enhancement due to saturation of the forbidden transitions in systems of two spins coupled by a dipolar interaction - was observed at both 300°K and 1.8°K in sucrose charcoals with adsorbed hydrocarbons. Here the paramagnetic electrons were those of the charcoal, while the nuclei were the protons of benzene or methane. Enhancements of 20 and 9 times the normal value of the polarization were observed at 300°K and 1.8°K, respectively. At 1.8°K the effect reached a maximum at about 1/10 the available saturating power (200 mw), and remained constant thereafter. A detailed theory of the Abragam effect was developed from the rate equations for the transitions involved. This led to an expression for the polarization:

$$P_N = \frac{2\mu_N H_o/\kappa\tau(W_1+W_3)}{B_1+B_2+2(W_1+W_3)+2C} - \frac{W}{A+W}\,\frac{|\mu_o|H_o/\kappa\tau(B_1-B_2)}{B_1+B_2+2(W_1+W_3)+2C}$$

where W and A are the natural and induced transition probabilities per unit time for the strong electronic transitions, W_3 and C are the analogous quantities for the strong nuclear transitions, and $W_1 = 2|m|^2 W$ is the natural transition probability per unit time for the forbidden transitions. Here $|m|^2$ describes the mixing of two states with the same electronic spin eigenvalue such that the eigenfunction of one of them is written $\psi_1 = \psi_1^0 + m\psi_2^0$, and that of the other $\psi_2 = \psi_2^0 - m^*\psi_1^0$. B_1 and B_2 are then the induced transition rates for the two forbidden transitions, B_1 being that for the transition at $\omega = (|\gamma_e| + \gamma_N)H_o$ and B_2 that for the transition at $\omega = (|\gamma_e| - \gamma_N)H_o$. The form of the polarization as a function of irradiating frequency was determined and agrees with the observed form within the accuracy of these measurements. Here A, B, and C are assumed to be Lorentzian functions of frequency, and $B(\gamma_e) = 2|m|^2 A(\gamma_e \neq \gamma_N)$. Good agreement within limits of experimental accuracy was also found for the polarization as a function of saturating power. It was observed that $2(W_3)B_1 + B_2$ over the total range of power used in these measurements. It was possible to measure the values of all quantities in the above equation, and this was done, although not as a function of frequency in the case of B_1 and B_2. While the accuracy of these measurements was not sufficient to make a rigorous quantitative criticism of the theory, agreement with the observations was close enough to substantiate all major features of it.

Overhauser enhancements were also observed at room temperature by saturating the electron spin resonances of $\alpha\alpha$diphenylβpicryl hydrazyl (DPPH) and of a solution of sodium in liquid ammonia. The nuclei polarized in these materials were protons. Polarizations of seven times the unenhanced value were found in DPPH and of about 600 times in $Na\text{-}NH_3$.

At 1.8°K no Overhauser enhancement was found in DPPH or in a single crystal of lithium fluoride containing F centers where the nuclei involved were F^{19}. Neither the low room temperature enhancement in DPPH or the absence of the effect at liquid-helium temperatures are understood.

Nuclear magnetic resonance was used to measure the polarizations. The electronic and forbidden transitions were saturated by microwave radiation at 9.2 KMc/s in a TE_{011} cavity. The nuclear magnetic resonance coil was placed inside the microwave cavity in such a way as not to interfere with the microwave field. Thus measurements could be made with both resonances excited simultaneously. Microfilm $2.00; Xerox $4.60. 87 pages.

STUDIES ON THE NUCLEUS OF ACANTHAMOEBA SP.

(L. C. Card No. Mic 59-4103)

Rose Elizabeth Cerroni, Ph.D.
Vanderbilt University, 1959

Supervisor: Professor Robert J. Neff

The present investigation was prompted by the finding that the nuclei of Acanthamoeba sp. were Feulgen negative or very weakly Feulgen positive despite considerable DNA per cell.

To eliminate the possibility of a special type of DNA localization, wherein part or all of the cellular DNA was localized extranuclear, nuclei were isolated from Acanthamoeba cells in isotonic sucrose and analyzed for their DNA content. It was found that the majority, if not all, of the DNA per cell was located within the nuclei.

In order to determine the factor(s) involved in the lack of Feulgen staining of Acanthamoeba nuclei, which had been shown to contain a relatively large amount of DNA, many diverse experiments were conducted.

Proteolytic digestion of fixed Acanthamoeba and unfertilized sea urchin eggs rendered the nuclei of these cells Feulgen positive. Nuclei isolated from Acanthamoeba cells showed intense Feulgen staining and this intensity appeared to be increased by protease digestion.

It was found that high concentrations of uranyl or ferric ions in the growth medium of Acanthamoeba rendered the nuclei Feulgen negative, and ferric ions in the growth medium of Tetrahymena, a very Feulgen positive organism, greatly reduced Feulgen staining.

A similar inhibitory effect was produced when fixed Acanthamoeba or Tetrahymena cells were exposed to the same ions either before or after acid hydrolysis but not after staining with Schiff's reagent. Other ions employed in these studies had no effect on the Feulgen staining of the nuclei of these cells.

The amount of dye bound in Feulgen stained macronuclei of Tetrahymena cells, which had been grown in the presence of iron or had been treated with iron after fixation, showed an average stain intensity depression to 39% $\pm$ 2.2. DNA analyses on cells from the same cultures, which had been Feulgen stained and the macronuclei measured spectrophotometrically, showed no significant difference in the DNA content of cells grown in the presence and in the absence of iron.

Iron grown whole Tetrahymena cells were greatly reduced in Feulgen intensity as compared with whole cells grown in the absence of $FeCl_3$ whereas aliquots of these same cell population which had been sectioned did not show differences in Feulgen staining.

Fixed Acanthamoeba cells rendered Feulgen negative by exposing the cells to 0.2 M $FeCl_3$ for 2 hours, when then incubated for 1/2 hour in 1 M cysteine in 1 M glycine buffer, pH 8, became Feulgen positive.

It has been postulated that a possible mechanism of the action of Feulgen inhibition by the ferric and uranyl ions is that these ions catalyze the oxidation of protein sulphydryl groups, in or around the nuclear membrane, to disulfide linkages yielding a barrier with pores so small that leuco-fuchsin cannot readily penetrate to the aldehyde groups exposed during acid hydrolysis.

In other investigations it was found that Acanthamoeba cells took up a very small amount of P^{32}. Autoradiographs of Acanthamoeba cells grown in the presence of P^{32} showed uniform labelling. Autoradiographs of Acanthamoeba cells incubated for 60 hours in the presence of tritiated thymidine showed an unusual uniform labelling of the cells. Autoradiography with uranyl acetate showed alpha rays emanating from Acanthamoeba cells but it was impossible to determine if the origin of these tracks was from within the cells.

Electron micrographs of an Acanthamoeba whole cell, cyst, isolated nuclei, and mitochondria were done to determine the purity of the Acanthamoeba culture and to determine if a morphological manifestation of a barrier to leuco-fuchsin was present. A comparison of the detailed morphology of the structures found in Acanthamoeba with structures in other protozoans is made.

Microfilm $2.15; Xerox $7.60. 163 pages.

THE EFFECTS OF COLLECTION METHODS AND CERTAIN STIMULI ON THE SECRETION RATE AND PHYSICO-CHEMICAL PROPERTIES OF MIXED AND INDIVIDUAL GLAND SALIVA OF THE BOVINE.

(L. C. Card No. Mic 59-3740)

Gabel Henry Conner, Ph.D.
University of Minnesota, 1959

One of the many complicated digestive processes in the ruminant animal centers around the role played by saliva. For many years it has been known that the bovine animal secretes large volumes of saliva in the course of a 24 hour period, however very little information is available on either the physical properties or the chemical constituents of the bovine salivary secretion.

To fulfill some of the requirements for basic research on bovine saliva, a study was undertaken with the following three main objectives: 1. To determine some of the physical and chemical properties of mixed, parotid, submaxillary, and sublingual saliva; 2. To determine the effects of different collection techniques on the physical and chemical properties of the mixed salivary secretion, and 3. To determine the effects of sympathetic and

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

parasympathetic stimulation on the physical and chemical properties of mixed saliva and on the secretion from the parotid, submaxillary, and sublingual salivary glands.

Non-lactating, non-pregnant Holstein-Friesian cows whose weights varied from 1,000 to 1,120 pounds, and whose ages ranged from four to six years, were used. Alfalfa hay was the only feedstuff these animals received throughout the duration of the study. Prior to experimentation a rumen fistula, equipped with a plastic plug, was established in each cow.

Mixed saliva was collected from the mouth by means of an aspiration apparatus; from the lower extremity of the esophagus by means of a tube, attached to a vacuum pump, inserted into the cardia (referred to as cardial collection or cardial saliva); and from the upper portion of the esophagus by means of an esophageal fistula. Individual gland saliva was collected from the parotid and submaxillary glands following permanent, bilateral cannulation of their respective ducts. The secretion entering the mouth and being swallowed during the periods of simultaneous parotid and submaxillary gland collections was designated as sublingual saliva and was aspirated from the esophagus via the cardia. All saliva collections were made without the use of anesthetic or tranquilizing agents.

For each of the different gland salivas and for each of the different collection methods employed for mixed saliva (except oral collection) the cows were subjected to drugs whose actions simulate stimulation of the sympathetic or parasympathetic nervous system. Sympathetic stimulation was effected by a continuous intravenous drip of ten milliliters of 1:1000 adrenaline hydrochloride given in a ten minute period. Parasympathetic stimulation was effected by an intramuscular injection of two and one-half grains of an aqueous solution of pilocarpine hydrochloride. In addition, a number of cardial stimulations (tube in cardia) were employed during collections of the various salivas.

For mixed esophageal fistula, mixed cardial, mixed oral, parotid, submaxillary, and sublingual saliva of the unstimulated bovine animal the following physico-chemical properties were determined: Flow rate, viscosity, specific gravity, surface tension, carbon dioxide combining power, hydrogen ion concentration, total solids, ash, total nitrogen, urea nitrogen, sodium, potassium, calcium, phosphorus, magnesium and hexosamine, as well as the 80 per cent soluble solids, ash and nitrogen.

The effects of pilocarpine hydrochloride (parasympathetic), adrenaline hydrochloride (sympathetic), and cardial stimulation on flow rate, viscosity, specific gravity, surface tension, carbon dioxide combining power, hydrogen ion concentration, total solids, and ash of mixed esophageal fistula, mixed cardial, parotid, submaxillary, and sublingual saliva were determined.

The levels of total nitrogen, urea nitrogen, sodium, potassium, calcium, phosphorus, magnesium, hexosamine, and the 80 per cent ethanol soluble solids, ash, and nitrogen were determined for the following salivas under the influence of stimulations as indicated: (a) Pilocarpine hydrochloride - mixed esophageal fistula, mixed cardial, parotid, and submaxillary saliva. (b) Adrenaline hydrochloride - mixed esophageal fistula, mixed cardial, and parotid saliva. (c) Cardial - mixed esophageal fistula, mixed cardial, parotid, and sublingual saliva.

Microfilm $2.00; Xerox $6.80. 144 pages.

THE RESPIRATORY SURFACE OF THE PURPLE SEA URCHIN (STRONGYLOCENTROTUS PURPURATUS).

(L. C. Card No. Mic 59-3698)

Allahverdi Abdoul-Hossien Farmanfarmaian, Ph.D.
Stanford University, 1959

A survey of the literature on the phylum Echinodermata indicates that the knowledge of the respiratory physiology of this phylum leaves much to be desired. There has been no systematic study of the respiratory mechanisms, particularly the respiratory surface, of the echinoids. In order to clarify some of these mechanisms and especially to identify the respiratory surface of S. purpuratus, quantitative (manometric) and qualitative (luminous bacteria) techniques were developed and successfully utilized. Comparisons with other echinoids were made whenever possible.

Using a special vaseline mixture, experiments were designed so that any desired area on the surface of the sea urchin was exposed or excluded from ambient oxygen. In this manner the oxygen uptake of all the surfaces naturally exposed to dissolved oxygen in sea water were quantitatively determined.

The results of these studies indicate that although the entire surface of S. purpuratus is capable of oxygen uptake, only the ambulacral podia serve as a respiratory surface through which the internal supply of oxygen is maintained. The dissolved oxygen is transported by means of the ciliary circulation of ambulacral fluid from the lumen of the podia to the ampullae and by diffusion across the ampullar membrane into the perivisceral fluid. Beyond the simple mechanisms of diffusion and ciliary transport, there seem to be no other mechanisms of transport, storage, or central control involved in the respiration of these organisms.

Microfilm $2.00; Xerox $5.80. 116 pages.

BLOOD FLOW AND CALCIUM TRANSFER THROUGH THE UTERUS OF THE CHICKEN.

(L. C. Card No. Mic 59-3581)

Walter George Hunsaker, Ph.D.
Rutgers University, 1959

Major Professor: Paul D. Sturkie

As there were no data in the literature on the rate of blood flow through the uterus of the chicken, a method was developed for determining the uterine blood flow based on the Fick principle. This method consisted of infusing 4-aminoantipyrine (4AA), via a jugular vein, and at the same time withdrawing blood samples from a carotid artery and a uterine vein simultaneously and continuously. At the end of the experimental period the hen was sacrificed and the uterus removed for analysis. From a knowledge of the 4AA content of the uterus and the integrated arterio-venous difference in plasma 4AA across the uterus for the experimental period, the rate of blood flow was calculated using the Fick equation.

When shell formation was not in progress the rate of

blood flow through the uterus was .43 ± .224 ml. per g. of tissue per min. (mean ± Std. dev.). During the early stages of shell formation the rate of flow was .94 ± .289 ml./g./min. compared to .71 ± .408 ml./g./min. shortly before oviposition.

Arterio-venous differences in plasma calcium were also determined. The mean A-V difference during active shell formation was 4.84 mg./100 ml. This difference represented a decrease of approximately 20 per cent in the level of total calcium in arterial plasma as a direct result of the transfer of calcium for shell formation. Toward the end of the shell formation period the A-V difference in total calcium was 1.52 mg./100 ml.

With the data for uterine blood flow and A-V calcium difference an estimate of the amount of calcium transferred by the uterine tissue per unit of time was calculated. During active shell formation the uterine calcium output was calculated to be .040 ± .022 mg. per g. of tissue per min. Toward the end of the shell formation period the rate of transfer declined to .014 ± .012 mg./g./min. The mean total calcium output of the uterus was .63 ± .35 mg./min. This rate of transfer would only account for about one third of the total amount of calcium transferred during the normal shell formation period. This suggests the values for blood flow or arterio-venous differences in calcium, or both, are too low. Probably the greater error occurs in the value for blood flow.

No inferences could be drawn from the data concerning which fraction of plasma calcium, ionic or protein-bound, was transferred to form the shell. During active shell formation the ratio between the two fractions was the same in the arterial and uterine-venous plasma. This indicated a very rapid shift from one form to the other following removal of calcium for shell formation.

Microfilm $2.00; Xerox $5.80. 117 pages.

OBSERVATIONS ON SOME METABOLIC DIFFERENCES BETWEEN TWO INBRED STRAINS OF MICE.

(L. C. Card No. Mic 59-4348)

Thomas Francis Kelley, Jr., Ph.D.
Brown University, 1959

The existence of strain differences in metabolism among four inbred strains of mice (A/Fn, C3H/Fn, C57Bl/Fn, I/Fn) have been demonstrated by Fenton. One of the most marked differences was the response of these four strains to a high-fat diet. Three of the strains (A, C3H, C57Bl) became obese, one (I) remained lean. This strain difference in response to the high-fat diet was the subject of this investigation. The strain that remained lean (I) and one of the strains susceptible to nutritionally induced obesity (A) were chosen for study.

The differences that were observed when these two strains were fed the high-fat diet could be due to either or both of two factors--first, a difference in control of food intake, and second, an actual difference in metabolism. The degree to which each of these two factors existed was determined. This was accomplished by feeding equal amounts of the diet to matched weanlings of both strains. It was shown that control of food intake accounted for much of the observed difference, but that an actual difference in metabolism existed as well. The A strain animals gained more weight, deposited more fat, and incorporated more nitrogen during the 30 day feeding period. Calculations of the caloric value of the difference in carcass composition suggested that the I strain animals possessed a significantly higher metabolic rate than the A strain animals.

Measurements of ketone body production by surviving liver slices from animals of each strain showed that both strains possessed an enhanced ability to produce ketone bodies after being fed the high-fat diet for two weeks. A second set of experiments showed that liver slices from I strain animals produced ketone bodies at a faster rate than did slices from A strain animals. This might indicate that I strain animals oxidize fat at a faster rate. The magnitude of the difference in rate of production of ketone bodies between the two strains was about the same as the difference in metabolic rate calculated in the pair-feeding experiment.

It was postulated that a difference in effective thyroid hormone output between the two strains could account for many of the observed differences. Measurements of thyroid hormone output indicated that I strain mice possessed the higher output. More evidence in support of this postulated difference in metabolic rate was the fact that I strain mice lost weight at a more rapid rate when fasted.

It was assumed that metabolic differences between the strains were, in part, a reflection of different endocrine patterns. The possible role of the thyroid has already been mentioned. Other studies had shown that I strain animals appear to have a greater insulin output. Attempts were made to use the relative rates of mobilization of fat to the liver in response to fasting as an index of growth hormone output between the strains. A strain mice mobilized fat at a markedly faster rate. This difference could be negated by injections of either growth hormone or crude anterior pituitary extract. This possible difference in growth hormone output agrees well with the faster rate of growth of A strain animals.

It was concluded that a difference in endocrine pattern and control of food intake can account for many of the metabolic differences observed between these two strains.

Microfilm $2.00; Xerox $3.00. 53 pages.

THE ELECTROPHYSIOLOGY OF FIBRILLAR-TYPE MUSCLE.

(L. C. Card No. Mic 59-3854)

Frances Veronica McCann, Ph.D.
The University of Connecticut, 1959

The neuromuscular system of the more highly specialized flying insects exhibits certain unique features, e.g., the presence of large diameter muscle fibers with component fibrils also of very large diameter (fibrillar muscle), and an asynchronous method of operation, i.e., the frequency of nerve impulses does not correlate in a 1 : 1 ratio with the wing-beat frequency. Fibrillar muscle and the asynchronous type of neuromuscular mechanism are associated with the relatively high frequency wing

movements which characterize the faster flying insects. The present study was undertaken to determine whether there are any unusual features in the electrical activity of individual muscle fibers and whether electrical activity differed in fibrillar-type muscle of insects of different Orders.

Electrical activity in single muscle fibers of insects representing four different Orders was investigated with intracellular microelectrodes. Insects examined were: Sarcophaga bullata, Parker (Diptera); Vespula diabolique (Hymenoptera); Nezara viridula (Hemiptera); Pissodes strobi, Peck; Tenebrio molitor (Coleoptera). The effects of direct and indirect stimulation and the effects of chemical agents were studied.

Indirect stimulation evoked only one type of action potential in the muscle fibers of the Diptera, Hymenoptera and Hemiptera. At least two types of action potentials were found in the muscle fibers of the Coleoptera. These potentials are influenced in some unique manner by the intensity of the stimulus. Transmitter activity also exhibited remarkable characteristics in the Coleoptera. The chemical agents ether and CCl_4 appear to exert a curare-type of transmission blockade at the neuromuscular junction of the insects mentioned above with the exception of the beetle Pissodes strobi. Carbon dioxide caused a rapid and complete depolarization of the muscle fiber membrane of Diptera and Hymenoptera, but caused only a curare-type neuromuscular blockade in the other insects (again with the exception of Pissodes strobi).

Combining this information with the data which indicate differences in the mechanical properties of the bee and beetle muscle, it is concluded that different types of fibrillar muscle serve different levels of mechanical specialization. Microfilm $2.00; Xerox $6.80. 145 pages.

THE USE OF AN OPEN SYSTEM FOR THE CULTURE OF THE RABBIT LENS.

(L. C. Card No. Mic 59-3819)

Bernard Schwartz, Ph.D.
State University of Iowa, 1959

Chairman: Professor H. M. Hines

Lens culture provides a useful experimental tool for obtaining an understanding both of the general physiology of tissue or organs in culture and in particular of lens metabolism and permeability. Closed, batch and open systems have been used to culture the lens. An analysis of the data from the literature on closed and batch culture systems indicate that large changes in concentration of metabolic substrate and end products take place in the media during the period of culture. Experiments with the closed system technique have shown the rate and extent of these changes. Significant differences exist between closed and open systems in biology and play an important role in the culture of the lens. In order to obtain a better simulation of in vivo conditions, an open or perfusion system technique is necessary for the culture of the lens.

The design and performance of a perfusion system for the culture of the lens has been described. Special care has been taken to emphasize some of the problems associated with this type of system such as the maintenance of sterility over the culture period, temperature, pressure and flow control, and continuous pH and redox measurements. The effect of flow pattern of the system on sampling has been discussed. The system has been constructed so that samples of fluid can be collected before (inflow sample) and after (outflow sample) contact with the lens.

Synthetic perfusion media for the culture of the lens based on the composition of the posterior chamber aqueous humor of the rabbit have been developed. Vitamins and L-amino acids were added as used in tissue culture media. Inositol and ascorbic acid were added at levels comparable to those found in the anterior aqueous humor. No antibiotics were used. A gas mixture of 9.3% O_2, 3.7% CO_2 and 87% N_2 was used to give comparable gas concentrations to those found in the anterior aqueous humor. The pH was based on the experimental determinations of pH of anterior aqueous as well as those reported in the literature.

Ascorbic acid was stabilized in the media by using reduced glutathione as a complexing agent for heavy metals present in trace amounts. An evaluation of the redox of the media in comparison to the redox of rabbit anterior aqueous was made by using closed system determinations. Changes in the concentration of ascorbic acid affected the redox of the media. The buffering capacity of the media was also determined. Methods of preparation and storage of the media were discussed.

Initial results of the use of the perfusion technique for the culture of the rabbit lens have been presented. Preliminary perfusion experiments indicated a flow rate of 3.5 cc./hr. and a reduced glutathione concentration of 1 mM./l. were required to maintain the pH and ascorbic acid concentration of the media. A concentration of 2 mM./l. of glutathione in the media produced large opacities in the lens.

Further experiments, each over a period of 2 to 3 days, maintained the transparency of the lens for an average period of 41 hours. At the end of the experiments, the lenses showed increased lactic acid and decreased total nitrogen, glucose and weight levels.

Analysis of media collected by continuous sampling revealed an increase in lactic acid and nitrogen concentration but decreased glucose and ascorbic acid values on the outflow side compared to inflow. A lag phase in pH outflow values was noted in some experiments before mean pH inflow values were obtained. The utilization production rates for glucose and lactic acid were higher than those obtained in closed culture systems.

Microfilm $2.80; Xerox $9.80. 216 pages.

STAPHYLOCOCCUS TOXIN SHOCK IN DOGS.

(L. C. Card No. Mic 59-3428)

Robert Mark Vetto, M.D., Sc.D.
University of Cincinnati, 1959

Septic shock has long been recognized as a dreaded complication of infection. Presumably, the clinical picture is the result of toxins elaborated by bacteria. While it is impossible to construct a practical animal experiment that corresponds exactly to septic shock, it was felt that a pathophysiologic study of an animal subjected to injections of a specific bacterial toxin might yield information regarding its nature.

Staphylococcus toxin was used. This material was prepared by Lederle Laboratories from Staphylococcus aureus, Wood strain 46. The broth media was sterilized by centrifugation and filtration after a 48 hour growth period, and standardized by determining the Lh and DND doses.

By trial and error a dose of 0.12 cc./K was found to produce a reasonable length of survival in dogs (163-318 min, av. 221 min.).

The dogs were anesthetized with intravenous nembutal, 30 mg./K, and placed on the operating table in the right lateral position. A left sided thoracotomy was performed through the fourth intercostal space and the animals ventilated with a Harvard piston type respirator through an inflated endotracheal tube.

In general, the following determinations were made:

1. Left ventricular pressure by trans-ventricular puncture
2. Right atrial pressure
3. Left atrial pressure
4. Femoral arterial pressure
5. Aortic or internal mammary pressure
6. Left ventricular contractile force by means of a strain gauge arch
7. Electrocardiograms
8. Cardiac output (two experiments)
9. Heart rate

In addition, autopsy was performed on all animals. Eight shock dogs were studied, while five dogs served as controls.

Almost immediately after administration of the toxin, regardless of route, a hypertension developed (in seven of the eight dogs) of 4 to 20 mm. Hg. which lasted from 3 to 16 minutes. This change was accompanied by bradycardia. Subsequent to this, the animal progressed into a hypotensive state, reaching a maximum point after an average of 42 minutes (range 15 to 64 minutes) post-toxin. The decline in systemic blood pressure averaged 61 percent of the baseline value. Meanwhile, the bradycardia, which had appeared along with the initial hypertensive change, became more pronounced as the blood pressure continued to fall.

This initial shock phase was followed by a period of recovery in which systemic pressure rose to an average level of 72 percent of the baseline value. The recovery phase was accompanied by an increase in heart rate.

In the final shock phase, the systemic pressure and heart rate began to decline gradually, and finally precipitously.

Both right and left atrial pressures fell during the initial shock phase. Atrial hypotension was maintained throughout the length of the experiment until the end of the final shock phase, when the right atrial pressure rose.

The results from the two cardiac output experiments were combined and expressed as percentages of baseline values. On the descending limb of the primary shock phase, the cardiac output dropped to 34 percent and the total peripheral resistance approximately doubled. At the maximum point of the initial shock phase and at the peak of the recovery phase, the outputs had further declined to 23 percent while the peripheral resistance was almost tripled. During the final shock phase the cardiac output was 15 percent and the peripheral resistance had decreased to one and one-half times the baseline value.

Electrocardiograms revealed the changes of subendocardial ischemia during the recovery phase. Bizarre changes were present in the final shock phase, consisting of arrhythmia, bundle branch block and complete heart block.

The most prominent finding at autopsy was marked hepatic congestion. When the toxin was given through either atrium, muscle hemorrhages occurred beneath the endocardium and in the papillary musculature.

The data collected is analyzed and discussed in relation to other reported studies in shock.

Microfilm $2.00; Xerox $3.00. 38 pages.

STUDIES ON THE EXCRETION OF MALIC ACID IN RELATION TO THE TRICARBOXYLIC ACID CYCLE IN THE KIDNEY.

(L. C. Card No. Mic 59-3429)

Pashupati Prasad Vishwakarma, Ph.D.
University of Cincinnati, 1959

The mechanism of excretion of malic acid was studied during infusion of sodium salts of citric, α-ketoglutaric, succinic, fumaric, and L-malic acid itself in the dog, using standard clearance technique. Infusion of all these acids led to an increase in plasma malic acid levels. Infusion of citric, α-ketoglutaric, and succinic acids caused glomerular filtration and net tubular secretion of malic acid. With each of these substrates, following addition of malonic acid, the tubular secretion of malic acid disappeared and a net reabsorption was seen. It thus appeared that the dog renal tubules are capable of synthesizing and secreting malate from these precursors. In contrast, infusion of fumaric and L-malic acids led only to glomerular filtration and reabsorption of malic acid. With graded infusion of L-malic acid itself a small but definite reabsorption of malate occurred which showed a maximal rate (Tm) at filtered loads above 6 to 8 mg. per minute. This reabsorptive Tm was independent of

urine flow, urinary pH, and rate of bicarbonate excretion. During fumaric acid infusion the quantities of malate reabsorbed were much larger at equivalent plasma levels and filtered loads of malic acid. Furthermore, fumaric acid in catalytically small doses augmented malate Tm. This augmentation effect of fumaric acid was not seen during pentobarbital anesthesia. Neither did fumaric acid have any effect on the quantities of malate utilized by the kidney under this anesthesia.

In order to study the nature of tubular secretion of malic acid further, recourse was taken to Sperber's technique (1948) using the chicken. With this technique the infusion of L-malic acid in one leg vein resulted in equal excretion rates of malic acid from the two kidneys, indicating no tubular secretion of this substance in the chicken. Infusion of succinate resulted in 8 to 10 times greater excretion of malic acid on the infused side than the other. Thus the chicken tubules also appeared to possess the ability to synthesize and secrete malic from succinic acid. It was thus evident that the renal tubular secretion of this acid is confined only to the locally synthesized malate and possibly occurs according to the concentration gradients between the intracellular and luminal fluids.

The administration of malonate during succinate infusion (but not malonate alone) actually caused an increase in malic excretion in the chicken. The mechanism could either be suppression of malate reabsorption or synthesis of malate from malonate after decarboxylation where the presence of succinate was necessary to overcome competitive inhibition of succinoxidase by malonate.

The mechanism of excretion of D-malic acid (the unnatural isomer of malic acid) was also studied in the chicken. This isomer was found to be actively and rather profusely secreted by the chicken kidney tubules in contrast to the findings with L-malic acid. Furthermore, this tubular secretion of D-malic acid was not affected by Benemid. There was apparantly no mutual interference between the secretion of D-malic acid and p-aminohippurate. Neither did priscoline and cyanine #863, the two inhibitors of the organic base secretory mechanism in the kidney, have any effect on D-malic secretion. It was, therefore, concluded that there are unique differences in the nature of renal tubular transport of these isomers and the secretory mechanism for D-malic acid in the chicken is separate from the commonly known mechanism for the secretion of all exogenous organic acids studied thus far.

Microfilm $2.00; Xerox $5.20. 103 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

POLITICAL SCIENCE, GENERAL

THE THEORY AND PRACTICE OF FEDERALISM IN THE GOVERNMENTAL ORGANIZATION OF THE CONFEDERATE STATES OF AMERICA

(L. C. Card No. Mic 59-3731)

Curtis Arthur Amlund, Ph.D.
University of Minnesota, 1959

Advisers: Professor Asher N. Christensen and
Professor Rodney C. Loehr

The founders of the Confederacy believed that sovereignty was indivisible and that the individual states comprising it retained their independence and sovereignty under the Confederate constitution. Yet the 1861 framers devised a fundamental document whose varied clauses facilitated the assertion and expansion of national powers as against those of the states. The war was a centralizing force; the momentum given the exercise of broad powers by the general government was carried forward under the sponsorship of constitutional provisions which made the government supreme within its own sphere of action.

Instead of establishing a political arrangement under which the Richmond government was made subordinate to the states in terms of power relationships, the South created a two-level jurisdiction of government. It is certain that sovereignty proved divisible between the two levels of government, each of which was sovereign within its own sphere of activity. Southerners necessarily had to bear allegiance to two distinct levels of jurisdiction, and within the sphere of action allotted to the central government a primary obedience was generally extended to it.

There was a division of powers between the central government and the "sovereign" states; moreover, the exact power distribution could not be altered by action taken alone on the part of the general government. Each level imposed its own taxes and secured compliance with its own regulations and laws; the statutes of each were in most instances implemented by a separate officialdom. To the states was assigned the large and undeterminate body of reserved powers; however, the area over which the sovereign states wielded these powers tended to become smaller as the war years continued. With respect to the power distribution between the two levels, the constitutional twilight zone located in the middle of this division was filled more and more by the "permanent" government of the Confederacy.

Just as the central government became active in a way unforeseen by the Confederate framers, so also did the states become more governmentally involved in political and economic life. Matters given the constituent units were substantial. The Richmond government was directly in contact with Southerners as individuals and not merely as citizens of the independent states. The individual states were not used as the instrumentalities through which national powers were asserted. The government drew authority from the people in the election of officials to the executive and legislative branches of the central government. Taxes were directly imposed on individuals by it; furthermore, the central administration was in direct contact with individuals through securing obedience to its own laws. The states were constitutionally at liberty to design their own forms of government and procedure, and constitutionally, they were guaranteed an absolute legal equality with one another.

Sovereignty became divisible even in a union of independent and sovereign states. If it is acknowledged that this condition developed, then the assumption can also be made that the Richmond government, a creature of the member states and founded to carry out their common interests, was something more than an "agent" government. The implication is that in practice the Confederacy was not only a union of states, but also one of individuals in important respects. By outlining an arena of governmental action within which the central administration would be supreme, the framers constructed a political framework under which the states had to relinquish some of their sovereignty to a general government that exerted its own powers on behalf of the Southern people as a whole. These assertions of power by the central government were generally sustained by the judiciary. The Confederacy, then, had features of federalism within its constitutional and practical workings.

Microfilm $4.55; Xerox $15.20. 355 pages.

HIGHWAY REVENUE AND EXPENDITURE POLICY IN THE UNITED STATES

(L. C. Card No. Mic 59-3567)

Philip Hyland Burch, Jr., Ph.D.
Rutgers University, 1959

Major Professor: Bennett M. Rich

This study attempts to describe and analyze the pattern of highway taxation and expenditures in the United States. The first section is devoted to an examination of the manner in which highway taxation practices and theories have evolved at the Federal, state, and local levels of government. The various types of motor fuel and registration charges levied today, the administration of tax refunds for non-highway use of gasoline, the relative merits of diversion versus the dedication of the motorist's tax dollar for road improvement purposes, and the present modes of Federal and local highway taxation are discussed from the standpoint of political feasibility, administrative effectiveness, and equity. The development of highway taxation in America, it is concluded, has tended to follow the line of least resistance and no

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consensus has as yet been reached as to the financial burden that should be carried by each class of beneficiary--the car-owner, the truck or bus operator, the property-owner, and the public at large.

In the realm of highway disbursements, the adequacy of local highway fiscal practices is analyzed according to size of administrative unit, the degree of engineering supervision employed, long-range project programing, and the functional classification of travel arteries. In one way or another, the vast majority of local governmental units fall short of these four criteria of good highway management.

The main emphasis of this dissertation, however, is focused on the political conflict between rural and urban areas as regards (1) the allocation of state aid to the local units, (2) the size and composition of a state highway system, (3) the pattern of expenditures on state highways, and (4) Federal aid policy. With the significant exception of the newly created Interstate highway program, rural forces have, generally speaking, held the upper hand on all four counts. There are primarily two reasons for the predominantly rural orientation that has characterized highway policy thus far. First is the fact that the metropolitan centers are grossly underrepresented in the average state legislature. Secondly, rural inhabitants have over the years displayed much more interest in securing highway improvements than most urban dwellers. The growing role of the new science of highway planning is also examined as a means of reducing the political pressures that have often molded roadway expenditure policy in the past.

In conclusion, an effort is made to weigh the impact of accelerated highway construction on other modes of transportation, the central city, America's mercantile and industrial pattern, and the changing farm economy. The increase in automotive travel caused by the provision of new motor vehicular arteries must of necessity have an adverse effect on the steadily deteriorating fortunes of the railroads and other public carriers in the United States. Furthermore, the gradual exodus of population and manufacturing and trade establishments from the metropolitan core to the outlying areas will, in all likelihood, gain considerable momentum as the nation's road building program is expanded. The mechanization of agricultural production and the subsequent decline in farm population, however, raise a serious question as to whether a disproportionate amount of revenue is being expended on local rural throughfares.

Microfilm $7.65; Xerox $26.20. 601 pages.

THE WISCONSIN GOVERNOR'S LEGISLATIVE ROLE: A CASE STUDY IN THE ADMINISTRATIONS OF PHILIP FOX LA FOLLETTE AND WALTER J. KOHLER, JR.

(L. C. Card No. Mic 59-3175)

L. David Carley, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor David Fellman

Students of American political institutions are well aware of the increasing role of the governor in state administrative and political affairs. Nevertheless, political scientists know very little about how the state governor actually goes about fulfilling what may be his most important job, that of legislative leadership. That is the purpose of this study: to analyze in depth, using the descriptive and historical method, the legislative roles of two widely known, long-term governors of Wisconsin.

Governors operate in the legislative process on the basis of two distinct kinds of power, those that are constitutional grants and those that are extra-legal. The constitutional powers of the governor in Wisconsin are much like those of other states. He must recommend measures to the legislature by way of messages, he may veto undesirable legislation, he may make certain appointments and he may call the legislature into special session.

Legislative leadership by the Wisconsin governor, however, may be exercised outside the constitutional delegation of powers. Among the extra-legal opportunities for legislative activity are the use of the prestige of the office to gain superior access to public opinion, the governor's party role, his influence on the party platform and his influence on the organization of the legislature.

Through the study of official state documents, legislative journals, gubernatorial messages, veto messages and interviews with the two governors, their executive assistants and many legislators who served during their tenure, it is possible to describe how each governor utilized his legal and extra-legal powers to gain passage of his announced legislative program.

The research produced, in addition to a descriptive analysis of the legislative roles of the two governors, a series of propositions about the Wisconsin governor's role in the legislative process. They are as follows:

Personal campaign pledges made by the governor have a significant effect on the legislature.

Gubernatorial appointments have little effect in commanding legislative support in Wisconsin.

The governor's legislative messages are the most important vehicle in submitting a legislative program.

While party institutions have not been particularly strong in Wisconsin, those governors that are party spokesmen achieve additional legislative support for their programs.

Governors that bring their influence to bear upon the organization of the legislature are able to achieve greater legislative support for their program.

Wisconsin governors have used the veto frequently. Wisconsin legislatures have been very reluctant in overriding such vetoes.

While there are rather serious legal (constitutional and statutory) restraints on the governor's capacity for legislative leadership, his extra-legal powers are sufficient so as to allow an extensive participation in the legislative process.

Philip La Follette, governor of Wisconsin from 1930 to 1932 and 1934 to 1938, was the unquestioned party leader of the Progressives. He presented large legislative programs in each of his terms in office and often sought to achieve success for his programs by appealing directly to the electorate. He took a direct hand in the organization of the legislature, he called it into special session and he used patronage to gain support for his proposals.

Walter Kohler, governor from 1950 to 1956, was not fond of party politics. He did not take part in the everyday political drama of the legislative process. He presented a modest legislative program which very likely reflected the tranquility of the times. However, on certain issues he was very willing to grapple with his own party leaders to achieve success for his program in the legislature. Walter Kohler practiced the doctrine of strict separation of powers in his executive-legislative relations. Philip La Follette disregarded the theory and exercised every opportunity to influence the legislative process. On the basis of a comparison of these two governors, it can be asserted that the legislative role of the chief executive of Wisconsin fits into no special groove, but varies according to time, circumstance and personnel.

Microfilm $5.25; Xerox $18.40. 409 pages.

THE POLITICS OF LEGISLATIVE APPORTIONMENT IN TEXAS—1921-1957

(L. C. Card No. Mic 59-2480)

Wesley Sisson Chumlea, Ph.D.
The University of Texas, 1959

Supervisor: Dr. O. Douglas Weeks

This dissertation attempts to analyze the apportionment process in Texas with emphasis on the underlying political considerations involved. It is limited to the period from 1921 to 1957 because during this era the State's greatest population expansion and relocation coincided with its longest interval between reapportionments. However, a projection of the Texas population to 1960 appears in the concluding chapter, on the basis of which an estimate is made of the changes expected to result when the State is reapportioned in 1961.

Because the apportionment of 1921 was disproportionately generous to rural counties whose population had begun to decline before 1921, failure to reapportion following the censuses of 1930 and 1940 led to still greater representational imbalance between urban and rural areas. Yet while rural legislators were more solidly opposed to reapportionment than others, neglect of reapportionment may not be attributed solely to the Legislature's rural majority. Members from the largest cities were not vitally concerned either, and a few even seemed to prefer the status quo. Not until the early 1940's did organized support for reapportionment develop, and even then the people of the Lower Rio Grande Valley rather than the residents of Texas' four largest cities were primarily responsible.

Although the Legislature did not reapportion during the 1930's and 1940's, it did submit two constitutional amendments, each of which had a profound effect on reapportionment in 1951. The first of these amendments, ratified in 1936, imposes a maximum on the number of seats that any one county may have in the House of Representatives, regardless of its population. The second amendment, ratified in 1948, created the Legislative Redistricting Board, an exofficio agency that was intended to redistrict only in the event that the Legislature failed to do so. Rather than have the job done by an executive agency, the Legislature reapportioned in 1951 and acquitted itself very well in comparison with its past performances. The redistricting, however, contained many inequities, a situation which, in the opinion of the author, will never be remedied until some neutral agency is made responsible for reapportionment.

During the period spanned by this investigation much talk was heard concerning the advisability of adopting unicameralism or some other drastic reform in the structure of the Legislature. Some of the changes that were suggested are still worthy of consideration, but it would appear that for some time to come the Legislature will continue to be apportioned on the basis of a Senate of 31 and a House of 150. Because the author holds this to be the case, the recommendations which he makes for improving legislative representation could all be adopted without changing the size of the Legislature or the number of legislative houses.

Studies similar to this one have been made in a number of other states and have vastly increased our knowledge of apportionment, as well as of the personal, partisan, economic, and sectional conflicts of interests that are involved in the process. Since no study of equal scope had been conducted in Texas, it seemed to the author that such an analysis would constitute a valuable addition to the literature on apportionment in Texas, as well as to the expanding material on state legislative apportionment generally.

Microfilm $3.55; Xerox $12.00. 274 pages.

THE POLITICAL THEORY OF JEAN-PAUL SARTRE

(L. C. Card No. Mic 59-3579)

Joseph Bunyan Hampton, Ph.D.
Rutgers University, 1959

Major Professor: Dr. Edward McNall Burns

The Political Theory of Jean-Paul Sartre is an attempt to understand the political thought of a contemporary French philosopher who believes that no philosophy can be termed a-political. Engrossed in the turbulent events of his own lifetime, Jean-Paul Sartre (1905-) has gained renown in many areas, as a novelist, playwright, philosopher, essayist, editor, and as the leader of a movement which excited popular interest, French Existentialism. Praised and damned, in some cases by the same observers at different times, Sartre has been recognized in Europe as an important man of our age, an intellectual of considerable brilliance. He has made a valuable contribution to the field of ontology with his work L'être et le néant (Being and Nothingness) and has gone on to be a disturbing and provocative critic of many of the serious maladies of contemporary life.

The philosophical basis for Sartre's entering partisan politics after World War II can be found in his metaphysical assumption that man makes his own essence by his actions and is responsible for every choice he makes, each act he performs. Man's liberty, although total in the sense of being unrestricted by a fixed nature or a supernatural power, exists only in situation, as man himself does. When a man faces his freedom, awesome in its implications, he must decide to engage himself within his situation, or else

attempt to negate his freedom and himself. In broad terms, Sartre sees twentieth century man in a situation which is predominantly political.

Sartre's emphasis on man's freedom and responsibility is a rigorous and healthy challenge to contemporary man who is in increasing danger of surrendering himself, not altogether regretfully, to the miasma of mass forces which he makes little effort to understand and has no expectation of affecting. But the void of Existentialism is immediately apparent when one considers how Sartre himself has met this challenge. Influenced by the background of the Enlightenment and the tradition of the French Left, Sartre has become, or at least professes to have become, a Marxist.

Sartre became an increasingly staunch defender of Russia and the French Communist Party until the Hungarian Revolution of 1956 when he repudiated Soviet imperialism. History came to be, for Sartre, the basis for ethical judgments. Man no longer stood in an original relationship to values, determining their worth by acceptance or rejection. Values were what aided the proletariat in its historical mission; and because Sartre believed that the Communist Party was the only true expression of the proletariat, he believed that refusal to support the Communists denoted a withdrawal from history.

Sartre is no longer in the Communist camp, but he remains a Marxist. The problem of attempting to discover the degree to which Marxism and Existentialism are logically compatible recurs frequently throughout the study of Sartre's political theory. A related, but more disturbing, problem is the possibility that if one accepts the Existentialist view that men exist in interminable conflict, one must search in vain for the basis of any hope for a better world.

It is inevitable that any comprehensive study of Sartre must reveal areas where contradictions are inherent and discrepancies are flagrant. This study attempts to establish that the careful reader of Sartre will benefit by being forced to reexamine his own ideas, confronted by the rich insights which Sartre provides into many of the age-old problems that confront man in organized society.

Microfilm $2.85; Xerox $9.80. 217 pages.

AN EXAMINATION OF THE FLORIDA EXECUTIVE

(L. C. Card No. Mic 59-4242)

Daisy Parker, Ph.D.
University of Virginia, 1959

The fragmentation of executive power and responsibility, with the decentralization of the executive and administrative organization, is brought about by constitutional and statutory provisions for: (1) the division of executive power among the governor, prohibited from immediately succeeding himself in office, and six elected executive officers, independent of each other and responsible only to the electorate, allowed to succeed themselves in office; and (2) the exercise of vital executive powers by ex officio boards composed of the governor and the six elected executive officers. The six officers are known collectively as "the cabinet," but the term is also used to mean the governor and the six elected executive officers.

The tradition has evolved that the Florida executive organization, "the cabinet system of government," lends stability and continuity to the state government and produces economy and efficiency. Fear of a strong governor, accident, chance, lethargy, and vested interests have provided a combination of circumstances to create an aura of sanctity about "the cabinet system of government." Floridians generally imperfectly understand the operation of the state executive.

The weak governor is expected to provide leadership and perform miracles of administration. His appointing and removal powers are restricted by the legislature and the ex officio boards. Budgetary powers belong to the ex officio Budget Commission, and vast administrative powers belong to other ex officio boards. Recently, however, the governor has been able to assume legislative leadership, even though the legislature is dominated by representatives from rural counties, because he is usually the representative of the under-represented urban counties. The six elected executive officers do not openly advocate or oppose the governor's legislative program; nor do they offer legislative programs of their own; but they do deal directly with legislators with whom they have many long-time friendships and attachments.

The state's rapidly expanding population and economy have demanded a tremendously enlarged executive and administrative organization. An uncoordinated, unintegrated executive structure, lacking central control and responsible direction, composed of units often performing duplicating and overlapping functions and services, has inevitably resulted under the cabinet system. The governor and the six elected executive officers do not have overall direction and control of administration. Many executive agencies are really responsible to no executive officer. A general organized personnel program and a central personnel agency are inevitably lacking in the Florida plural executive arrangement.

It would be politically impossible to reorganize the Florida executive by means of extensive constitutional changes. The provisions for the six elected executive officers will remain in the Florida constitution along with those for certain ex officio boards. Nevertheless, certain constitutional changes may be achieved either by constitutional amendments or statutory enactments. It may be possible within the next decade to pass constitutional amendments allowing the governor to serve two successive terms and removing the penal system from the control of a cabinet officer. It is not unreasonable to hope for statutory changes which will: (1) allow the governor to appoint department heads of divisions which serve under ex officio boards; (2) expand the governor's staff; (3) coordinate terms of office of executive officers engaged in policy-making with the term of the governor; (4) extend the merit system to more executive units; and (5) consolidate certain executive agencies and eliminate others. More difficult to achieve but still within the realm of possibility are statutory changes to: (1) give the governor the budgetary power; (2) remove certain administrative agencies from the control of ex officio boards and place them under the control of the governor; (3) give the governor veto power on the ex officio boards; and (4) provide a central purchasing system under the administrative control of the governor.

Microfilm $3.25; Xerox $11.00. 249 pages.

LAW ENFORCEMENT IN THE CLEVELAND METROPOLITAN AREA: A STUDY IN INTERGOVERNMENTAL RELATIONS

(L. C. Card No. Mic 3967)

Richard Abernathy Watson, Ph.D.
University of Michigan, 1959

The purpose of this study is to determine how the general framework of government in Ohio, and institutions for the maintenance of the peace in particular, shape the process for the enforcement of state law in the Cleveland metropolitan area. Emphasis is placed upon determining the major weaknesses in law enforcement created by these factors and the extent to which officials are able to mitigate these deficiencies through formal and informal cooperative arrangements.

The dissertation is divided into three major parts. The first two chapters contain background material designed to point up the special considerations affecting law enforcement in a metropolitan area. The historical development and essential characteristics of these communities, together with attempts to govern them, are outlined in chapter I; also included is a summary discussion of traditional American enforcement institutions. Chapter II treats these same matters in the Cleveland metropolitan area alone.

The main body of the dissertation is devoted to a study of the enforcement process as it actually operates in Greater Cleveland. The various aspects of the enforcement process--criminal investigation, prosecution, basic patrol, traffic, records, communications, and training--are analyzed in terms of the part which each of the governmental agencies plays in these various aspects of enforcement. Disparities in legal powers and prevailing practices in law enforcement are delineated, and attention is directed towards the cooperation which exists between agencies growing out of both formal and informal arrangements. Included in the treatment are statistical analyses of recent trends with respect to criminal offenses, the prosecution of felonies, and traffic accidents.

The final chapter of the dissertation summarizes the major findings of the study. It also evaluates various alternatives for improving law enforcement in terms of the enforcement needs of the Cleveland metropolitan community and the legal and political possibilities for reform.

The statistical data analyzed indicate the following developments affecting law enforcement in the Cleveland metropolitan area. 1) The number of crimes and traffic accidents has risen in Greater Cleveland in recent years; in the eighteen cities whose crime records were studied, major felonies rose some 34 per cent in the period from 1952-1957 as contrasted to a 5 per cent population increase during that time. 2) In the last three years, the rate of crime increase in suburban communities has been exceeding that of the central city; moreover, statistics reveal that a disproportionate number of traffic fatalities are occurring in the villages in the county. 3) Suburban police departments generally are not as successful as is the Cleveland Police Department in clearing offenses by arrests; also, felony cases originating in the villages in the county result in a greater percentage of "no bill" findings and "not guilty" verdicts than do those originating in Cleveland and the suburban cities.

An analysis of the law enforcement process indicates that the maintenance of the peace in Greater Cleveland is handled almost exclusively by municipal agencies. The major weaknesses created by the decentralized enforcement mechanism are as follows. 1) The townships and half of the villages in Cuyahoga County fail to provide minimum standards of basic police services in the form of round-the-clock protection by full-time personnel. 2) Specialized police services are available only in Cleveland and the larger suburban communities, and 3) there is a lack of coordination of the activities of the many enforcement agencies operating in the metropolitan area.

The study of cooperative arrangements prevailing in the enforcement field reveals that they are primarily attributable to the efforts of individuals who worked against handicaps imposed by the enforcement system. Further significant improvements can come only through changes in the system itself. The most feasible approach lies in transferring certain aspects of law enforcement which require centralized treatment to the county, while leaving basic protection to individual municipalities providing they comply with mimimum standards prescribed by the county. Microfilm $3.65; Xerox $12.40. 281 pages.

SOME CORRELATES OF POLITICAL STABILITY IN A POLISH-LANGUAGE VOTING PRECINCT IN THE DETROIT METROPOLITAN AREA

(L. C. Card No. Mic 59-3969)

Sylvester Joseph Wodka, Ph.D.
University of Michigan, 1959

The purpose of this study is to investigate the nature and bases of political affiliation in a one-party, minority-group community. The study seeks to identify some of the correlates of affiliation which contribute to continued one-party dominance. Differences in strength of affiliation within the dominant party also are investigated in relation to these correlates. An incidental purpose is to describe some of the political behavior patterns in this type of community.

The results of the investigation are presented as both a statistical study and a descriptive case study; however, because of the small number of cases involved, no claims of statistical validity are made, unless specifically indicated. The statistical data are for comparative and suggestive purposes only; the primary value of the study is heuristic.

The area selected for study, the Eleventh Precinct of Hamtramck, Michigan, was chosen on a subjective basis. The criteria for selection were: a consistently high one-party vote over time, a heavy preponderance of population with Polish ethnic background, and a reasonably stable population.

The data were secured from a sample interview-survey taken in the spring of 1957. All city blocks in the precinct were included in the sample. The households at which interviews were taken were selected on a random basis, and individuals within the households to be interviewed were selected through use of random-selection tables. The data are based on eighty-two interviews, though the study concentrates on the Democratic Party (the dominant party) affiliates within this group.

Some of the more important variables examined in relation to political affiliation include: selected economic characteristics--i.e., family income, occupation, home-ownership status, and socioeconomic class; selected demographic and other noneconomic characteristics--i.e., sex, age, length of residence in the community, place of birth, ethnic background, and religious affiliation; perceptions of affiliation of interpersonal associates--i.e., parents, family, personal friends, co-workers, and co-members of formal organizations; extent of political participation and political discussion; political attitudes; ethnic and religious attitudes; and perceptions of the political role of the Catholic Church in the community.

The findings are presented as suggestive, rather than conclusive. In general the findings indicate that among the more important correlates of Democratic affiliation is the long-term political attitudinal predisposition toward a Democratic affiliation. Democratic affiliation, to some extent, has been incorporated into the mores of the community and is a function of community integration. This normal Democratic affiliation is reinforced by other mechanisms operative in the community; among them are a series of mutually reinforcing interpersonal relationships with others who are Democratic affiliates, or who are perceived as being Democratic affiliates, and a strong consciousness of the double-minority status held--i.e., Polish in ethnic background and Catholic in religious affiliation. Attitudes on questions related to those two factors appear to be more important as determinants of voting than are attitudes toward political issues.

There is some differentiation between the strong and the weak affiliates of the dominant party on the basis of characteristics which, in a two-party area, could be expected to differentiate between the Democrats and the Republicans, but this is not true on an attitudinal basis, nor on the level of political participation.

The community "expectation" of Democratic affiliation, and the power of reinforcement agencies, is so overwhelming that even those displaying normally Republican characteristics tend to be Democratic affiliates. This normal Democratic affiliation appears to be reinforced, to some extent, even by nonpolitical community agencies--e.g., the Catholic Church.

Microfilm $3.45; Xerox $11.80. 268 pages.

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

VOTING PROCEDURES AND PRACTICES IN THE SECURITY COUNCIL OF THE UNITED NATIONS

(L. C. Card No. Mic 59-3939)

Melvin Maurice Marcus, Ph.D.
University of Michigan, 1959

This study has been undertaken to develop a better understanding of how the Security Council of the United Nations has attempted to carry out its functions under the Charter in a political context not foreseen in 1945. It draws upon the relevant experience of the League of Nations, the views of the drafters of the Charter and the leading commentators, as well as upon the actual practice of the Security Council and related organs of the United Nations.

Part I of the study deals with the basis upon which the Council has interpreted the Charter in carrying on its work. It is concluded that so long as the Charter remains a living document, the organs established under its authority will be engaged in a process of constitutional interpretation. This is especially so for the Security Council, since its voting procedure as provided in the Charter is related to the ability of the Council to carry out its primary responsibility for the maintenance of international peace and security.

Part II of the study examines a number of preliminary determinations that the Council might be expected to make if the terms of the Charter were followed literally. These include agenda problems, and a variety of determinations on such matters as competence, the nature of matters before the Council, the identification of the parties involved, the right of the parties to be heard, etc. It is seen, however, that the Council has developed flexible procedures which have increased the effectiveness of the Council and reduced the opportunities for the exercise of the veto by the five permanent members of the Council.

In Part III attention is given to the exercise of the veto by those permanent members in terms of the determination of the procedural or substantive nature of many of the types of actions taken by the Council. Included in the latter are decisions involving investigations, pacific settlement under Chapter VI, decisions under Chapter VII, relations with other organs of the United Nations, etc. Attention is also given to the problem of the double veto. On the basis of this examination we can conclude that the practice of the Council indicates that certain matters are clearly procedural, others clearly substantive and that some lie in a grey area in between or have not yet been covered by the jurisprudence of the Council.

Part IV contains an examination of some of the voting and procedural practices by which the Council has been able to reduce the exercise of the veto, such as the development of parts voting, the consensus procedure and voluntary abstention. Moreover, it is shown that the effect of a veto can be overcome under certain circumstances.

General conclusions and observations make up Part V. Emphasis here is placed upon the fact that the Council has developed its voting and procedural practices within a dual legal and political framework. While it is concluded many of these practices are legally imprecise, they can be used by the members of the Council, particularly its five permanent members, as well as the other members of the Organization, if they wish the Council to assist in maintaining the peace.

Microfilm $6.15; Xerox $21.40. 484 pages.

THE SOVIET UNION AND THE ARAB EAST, 1947-1957: A STUDY IN DIPLOMATIC RELATIONS

(L. C. Card No. Mic 59-4096)

Oles M. Smolansky, Ph.D.
Columbia University, 1959

Until quite recently the development of Soviet-Arab relations has been neglected in the Western world, despite its impact on the Western positions in the Arab East. At the same time certain misconceptions concerning both Soviet and Arab motivations and policies have been fairly widespread. On the one hand, there has been a tendency to regard Stalin's death in March 1953 as a turning point in the Soviet attitude toward the Arabs. While Soviet policies were said to have followed an anti-Arab line before 1953, the situation had allegedly changed abruptly when the "collective leadership" came to power. On the other hand, a view has been held that improved relations between the "neutralist" Arab states (Egypt in particular) and the U.S.S.R. in 1955 and later constituted a Soviet-Egyptian alliance.

In this study, analyzing and comparing Arab and Soviet foreign policies, an attempt has been made to ascertain the motivations behind them, to detect possible areas of conflicting or overlapping interests, as well as to establish their relation to Western interests and policies in the Middle East.

More particularly, as a result of close investigation the conclusion appears warranted that in the period between 1947 and 1957 Soviet long-term objectives in the area (elimination of Western influence and, finally, complete and undivided control over the Middle East) have apparently remained unchanged while Moscow's strategy and tactics underwent considerable fluctuations. The U.S.S.R. switched from endorsing the state of Israel in 1947-1948, to a policy of full moral and diplomatic support of the Arabs in 1955-1957.

In their attempt to win over the "neutralist" Arab bloc, the Soviet leaders encountered in the Arab East a situation favorable to their endeavors. In the eyes of the "neutralist" Arabs the formation of the Baghdad Pact in early 1955 was a desperate Western attempt to split the Arabs so as to forestall their march toward complete political independence, unity and social-economic progress. Thus the Baghdad Pact provoked a new alignment which permitted some of the Arab-Soviet differences to recede into the background, and created an outward impression of basic unity of interests between the U.S.S.R. and the "neutralist" Arab states. But it was far from being an alliance. At a time when the Arab states were interested in stabilizing the region militarily and economically in view of what they described as fear of Israeli aggression and Western encroachments, the Soviet Union attempted not only to eliminate the Western powers from the area but also to take their place in the economic and cultural spheres of Arab life, thus creating an important basis for further consolidation and enlargement of its position in the Middle East.

Therefore, and despite the fact that an area of partial agreement existed between Moscow and the Cairo-led group of Arab countries in their common opposition to Western attempts to stabilize and strengthen the area on Western terms, it is impossible to speak of a unity of interests between the U.S.S.R. and the "neutralist" Arab states. Microfilm $5.15; Xerox $18.20. 401 pages.

POLITICAL SCIENCE, PUBLIC ADMINISTRATION

THE CALIFORNIA HIGHWAY PATROL: A STUDY IN ADMINISTRATION

(L. C. Card No. Mic 59-2483)

Allen Z. Gammage, Ph.D.
The University of Texas, 1959

Supervisor: Dr. J. Alton Burdine

The author developed a specific interest in the administration of the California Highway Patrol through association with its members and the knowledge that the Department had received, in the past several years, the highest awards in traffic supervision given by the National Safety Council and the International Association of Chiefs of Police. Although some rather detailed reference is made to the possibilities of reorganization and changes in management and enforcement policy of the department of the California Highway Patrol, the primary aim of the dissertation is to describe the present-day organization, policies and procedures of the Department as an instrument of administration and to indicate how well it is accomplishing its purposes.

In introducing the subject an attempt is made to summarize briefly the developments which led to the state police and highway patrol movement in the United States, those which culminated in the establishment of the California Highway Patrol, and the more important aspects of the organization of the latter as provided by law. Emphasis is also placed on organizational, numerical, and financial growth. Chapter II presents a more detailed account of the organization and its normal activities.

The next several chapters enter into the developments, problems, policies, and procedures involved in the management of the widely dispersed state traffic organization. The magnitude and the accomplishments of the Department in personnel management are brought out in a detailed analysis of personnel management functions including position classification, qualifications for appointment, the selection process, compensation, conditions of employment, performance reports, disciplinary action, layoffs and demotions, transfers, separation, reinstatements, and training. The extensive attention given to the records and communications functions of the Department emphasizes the importance of these activities in day-to-day operations as well as their significance as a basis for the formation of management and enforcement policy. Chapter VI presents the basic enforcement problems of the Department and explains how policies of patrol, accident investigation, accident analysis, evaluation, planning, experimentation, and selective enforcement are directed toward the solution of these problems.

Chapters VII and VIII, respectively, explain business and general management functions as they are directed toward the accomplishment of the goal of the California Highway Patrol through the various units and levels of authority in the organization. Planning, budgeting, organizing, directing, coordinating, controlling, and supervising are treated as integral parts of the management function.

The final chapter describes the California Highway Patrol as the product of its own determination to progress in the field of traffic law enforcement and presents its success in terms of the progressive attitude and unified

work of all members and employees of the Department in the execution of sound administrative principles and the application of professional techniques. The author's constructive suggestions for improvement take the form of recommendations for increased manpower, rearrangement of and additions to the organizational structure, and changes in enforcement and management policies and procedures. Microfilm $5.15; Xerox $18.20. 403 pages.

A REVIEW OF POINT SYSTEMS WITH RECOMMENDATIONS FOR ADMINISTRATIVE PROCEDURES: A STUDY OF THE SYSTEM DETAIL AND ADMINISTRATIVE PROVISIONS OF CURRENT POINT SYSTEMS WITH RECOMMENDED ADMINISTRATIVE PROCEDURES OBTAINED BY UTILIZING ADMINISTRATIVE EXPERIENCE

(L. C. Card No. Mic 59-1938)

Wallace Nathaniel Hyde, Ed.D.
New York University, 1959

The development of an objective system to identify and control problem drivers has posed a major problem to driver improvement administrators. With the enactment of driver license statutes each jurisdiction has been faced with the problem of adopting a procedure to be used in driver improvement. Of the several systems devised over the past thirty years, the "point system," inaugurated by the State of Connecticut in 1947, appears to be the most effective and objective procedure yet designed.

Since its introduction in Connecticut, the point system has experienced rapid growth. Today there are twenty-seven jurisdictions in the United States and Canada using some version of this system. Although most of them, in general, were patterned after the original system, their system detail and administrative provisions show considerable diversity. Such variations are not considered to be desirable inasmuch as they confuse motorists and make the administration of driver improvement more difficult. Numerous administrators have voiced a need for research that would culminate in recommended administrative procedures for the point system and eventual uniformity among jurisdictions using this system. Accordingly, this investigation was undertaken for the purpose of determining the characteristics of current point systems and developing administrative procedures to be recommended for adoption by jurisdictions using the point system.

Current practices were determined by administering an extensive questionnaire in a personal interview with the driver improvement administrator in each of twenty-five jurisdictions. It was found that all twenty-five systems perform the same basic function of identifying cases for review or action by assigning specific demerits for convictions of violations and other events pointing to a need for driver improvement. However, practices and procedures employed by the separate jurisdictions for performing this function differ widely.

The data collected by the questionnaire were presented in graphic form to eight experienced driver improvement officials who had been selected to serve as a "panel of administrators" to help determine desirable point system features. Each of the eight administrators was then interviewed to obtain his opinion on numerous administrative procedures. The data obtained in the interviews were analyzed and statistically treated to provide a basis for recommending specific administrative practices and procedures.

A schedule of point assignments for specific violations was taken from the concurrent research conducted by the American Association of Motor Vehicle Administrators. This research involved an extensive study of the driving records of 45,000 drivers selected at random from the files of the North Carolina Driver License Division. The appropriate weights for specific violations were determined by the use of a multiple regression process.

An investigation concerning the constitutionality of discretionary point systems disclosed two instances in which the higher courts of a jurisdiction had handed down an opinion. South Carolina's discretionary point system was declared an unconstitutional delegation of legislative authority by her Supreme Court; while on the other hand, the Court of Appeals of the State of Kentucky rejected this line of reasoning and ruled Kentucky's discretionary point system constitutionally sound.

These two cases, obviously, contribute very little toward settling the question of the constitutionality of discretionary point systems. The fact that twenty jurisdictions are currently operating point systems founded on similar foundation statutes appears to indicate that a discretionary point system would be acceptable to most jurisdictions.

The recommended administrative practices and procedures for administering the point system, presented in the report of this investigation, may prove to be of value to jurisdictions currently using the point system for improvement and to jurisdictions contemplating the future use of the point system. In addition, the report should help the cause of driver improvement in general through improvement of the procedures by which problem drivers are identified and proper action initiated.

Microfilm $2.30; Xerox $8.00. 175 pages.

ADMINISTRATIVE DEMOCRACY: A CREATIVE UTOPIA

(L. C. Card No. Mic 59-3278)

Holtan Peter Odegard, Ph.D.
The University of Wisconsin, 1959

Supervisor: Professor James L. McCamy

Under 20th century conditions, particularly the conditions brought about by technological developments, exclusive identification of democracy with representation and majority rule is no longer possible. When the administrative way of life begins to eclipse the legislative way of life in scope and importance, it is time to look not only at what it does but at what it can and should do, and to see if it can be made specifically democratic.

Traditional thinking about democratic political institutions has been grounded in what are now understood to have been erroneous accounts of human nature. This dissertation accordingly seeks to base a theory of democracy appropriate to the administrative age in recent experimental findings in the psychology of perception and to

establish the developing "transactional" understanding of the human condition (inaugurated by John Dewey and Arthur F. Bentley) in place of the discrete individualism that heralded the advent of representative institutions and still hedges our thinking about them.

More's Utopia appears to have been based on actual observations of human nature as it showed itself in ancient Peru. In contrast, administrative democracy looks forward to a progressively improving understanding of human nature and pretends only to a beginning understanding of some of its implications as uncovered by experimental investigation. It is thus intimately allied with what has been found to be the most reliable way of knowing--scientific inquiry.

But government, politics is preeminently a moral enterprise; it deals in purposes and conflicts of purposes. This dissertation analyzes the interrelations between the experimental way of knowing and the purposes of the knowers involved. It then identifies the "master" science, moral science (political science) as that which deals experimentally with human purposes, with intentions by instituting changes (on purpose change of purpose) and observing consequences. To become a viable way of knowing, to achieve results, such science must necessarily be democratized. Experimental handling of purposes can be achieved only as a third ("citizen," "subject-matter") scientist joins our traditionally distinguished pure and applied scientists, that is, only as the purposer participates in the experimental changing of purposes.

The product of scientific inquiry is knowing how to gain ever more satisfactory results. As this is achieved in physical science, men attain control over environment. In such knowing is a "functional" kind of power that can be applied without magic, without doing violence to nature. As such knowing how is achieved in moral (democratic) science, men will attain control over themselves, social control made up of contributory self-controls. They will learn how to make social power "functional" so that it is neither spur nor carrot but is companionable to the changing nature of the human being-doing.

Representative democracy has, for the most part, marked its success with struck bargains, with compromises balancing coercive powers of conflicting interests. Participation has been celebrated in the vote, an algebraic summation of unrelated or chance-related (uncontrolled) opinions of discrete individuals. Administrative democracy organizes for the possibility of creative bargains (Max Otto; Mary Follett's "integration") characterized by participation that intentionally integrates conflicting purposes by the creation of new and improved purposes which are then embodied in plans for coordinated action. Administrative democracy becomes a creative way of making (not finding) the public interest. As knowing how is achieved by scientific treatment of this process of purpose changing (Horace Fries' "scientific mediation"), the furious activity of direct participation is permitted to subside, much of it to be displaced by vicarious participation through verified knowings. The leadership of public administration achieves functional power for strategic social controls through creative planning processes grounded in the self-controls of citizen scientists. Microfilm $5.10; Xerox $17.00. 398 pages.

PUBLIC ENTERPRISE: A STUDY OF SOME ASPECTS OF MANAGEMENT CONCEPTS WITH PARTICULAR REFERENCE TO THE PORT OF NEW YORK AUTHORITY AND THE PORT AUTHORITY OF THAILAND

(L. C. Card No. Mic 59-4042)

Somburana Sri Supandit, Ph.D.
Indiana University, 1959

Chairman: J. B. Kingsbury

This is a study in the borderland of public administration and business management. It reflects the author's background of experience in government and business in Thailand, followed by advanced academic study in business management and in public administration in the United States; and his belief that a combination of these two disciplines provides a useful preparation for dealing with governmental problems in Thailand, where public and private enterprise are not sharply separated.

The purpose of the study is to compare the organization and management problems of public and private enterprise with a view to learning to what extent the management concepts developed in private enterprise can be applied to public enterprises.

The rise of public enterprises in various countries is traced, with special attention to the United States and Thailand. State enterprises may take the form of regular governmental departments, joint stock companies, or public corporations. Whatever the form, the characteristics that differentiate them from older governmental functions are their more limited and specific objectives (the conduct of specific industrial, commercial, or financial activities); their similarity to business enterprises; and a greater degree of financial and operating autonomy than is possessed by regular governmental departments.

The chief management problems of public enterprises grow out of their dual responsibility for (a) prompt and business-like performance of specific public services, and (b) meeting the requirements of public accountability imposed by their governmental nature. These dual responsibilities sometimes appear to be in conflict. The nature of the conflict is examined, and the possibilities of a reconciliation are explored.

The development of business management is traced from varied and highly individualistic forms to something approaching a science of management. The modern concept of "management by objectives" is described, and proposed as a possible solution for the problems of management of public enterprises. Management by objectives emphasizes the goals of the organization, and is in contrast to concepts of management which stress authority, hierarchical order, span of control, and other orthodoxies.

The Port of New York Authority is described as a type embodying the concept of management by objectives; and the Port of Bangkok as a contrasting example of a public enterprise in which management follows traditional and authoritarian patterns.

Microfilm $2.50; Xerox $8.80. 191 pages.

PSYCHOLOGY, GENERAL

THE EFFECTS OF INDIVIDUAL RESPONSE SETS ON MEASURES OF MENTAL SPEED

(L. C. Card No. Mic 59-3689)

Robert Brasher Clarke, Ph.D.
Stanford University, 1959

The purpose of this research was to investigate the nature of that mental speed variance which is not related to level. The general plan involved measuring individual differences in two response sets and determining how much of the variance of various time measures they could account for in a situation where the Ss were instructed to work as rapidly and as accurately as possible on material of greater than zero difficulty.

The following hypotheses were generated:

(1) There are reliable individual differences in the tendency for a person to guess rather than omit the answer to an item which is impossible for him, when there is some penalty for guessing. This was referred to as G-set.

(2) There are reliable individual differences in the length of time a person persists on an item which is impossible for him when he is under instructions to work both rapidly and accurately. This was referred to as P-set.

(3) The average time spent on wrong items will be negatively correlated with G-set.

(4) The average time spent on wrong items will be positively correlated with P-set. Both hypotheses (3) and (4) were developed on the basis that the items an individual does incorrectly out of a fairly difficult set of items are those which are most difficult or impossible for him.

(5) The average time spent on correct items will be negatively correlated with G-set.

(6) The average time spent on correct items will be positively correlated with P-set. Both hypotheses (5) and (6) were developed on the bases of (a) a sort of "ceiling effect" due to individual differences in the maximum times spent on a single item, correct or incorrect, and (b) the times spent on items impossible for the individual but whose answers he correctly guessed.

(7) The absolute magnitudes of the correlations in (5) and (6) above will be positively related to the difficulties of the items in the test.

Two separate experiments were performed, one in which number series completion items, and another in which sentence completion items, were used. Eighty elementary psychology students were used, 40 for each experiment. In both experiments a G-set score and a P-set score were obtained for each S by using specially constructed impossible problems. The G-set scores were obtained under conditions where the Ss knew they were to be penalized for wrong answers, and the P-set scores were obtained under conditions where the Ss were instructed to work as rapidly and as accurately as possible. Then in both experiments the time measures appropriate for testing hypotheses (3) through (7) were obtained under speed and accuracy conditions and were then correlated with the set measures. Furthermore, speed ability scores based on items of zero difficulty were obtained for the Ss in both experiments and were partialled out of the correlations used to test hypotheses (3) through (6) in order to avoid the possible interpretation that positive results might be due to common speed ability variance.

In both experiments the P-set and G-set measures were highly reliable and not related to any substantial degree to either speed ability or verbal or numerical aptitude level. Furthermore, P-set accounted for substantial amounts of the variances of the wrong and correct times, thus confirming hypotheses (3) and (6). Also, hypothesis (7) was confirmed for P-set. On the other hand, the amounts of the time variance possibly accounted for by G-set were very slight and for all practical purposes negligible.

Thus, it was concluded that, although G-set is of little importance, individual differences in P-set could well have been responsible for substantial portions of the variances of the measures used in research on mental speed.

Microfilm $2.00; Xerox $5.00. 98 pages.

THE EFFECTS OF CHANGES IN PATTERNS OF COMMUNICATION ON THE BEHAVIORS OF PROBLEM-SOLVING GROUPS

(L. C. Card No. Mic 59-3456)

Arthur Martin Cohen, Ph.D.
Boston University Graduate School, 1959

Major Professor: Warren G. Bennis

This is a laboratory study of the effects of changes in the patterns of communication of small problem-solving groups. These changes are in terms of who-can-communicate-to-whom. The overall question to be answered is: What effects do changes made in the communication patterns of problem-solving groups have on performance?

Two five-person communication patterns were used: (a) a Circle, in which every member could communicate to the persons on the immediate left and right, but to no one else. All members are equal with respect to the centrality indices [1] of their positions; (b) a Wheel, in which each of the four members could communicate to the fifth, but to no one else. The fifth person could communicate to everyone.

Four experimental conditions were used: (a) a change from a Circle to a Wheel (CW); (b) a change from a Wheel to a Circle pattern (WC); (c) a Wheel pattern throughout (WW); (d) a Circle pattern throughout (CC). Wheels have higher group centrality indices than Circles.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The task required members to find the common symbol from among six possible ones, through written communication only.

Diagram of Experimental Arrangement of Communication Conditions

Trials 31 - 60

Trials 1 - 30	C (Circle)	W (Wheel)
C	10	10
W	10	10

Ten groups in each of four conditions: CC, CW, WC, WW.

Five subjects in each group: C = Circle W = Wheel

By comparing the performances of CW with WW and WC with CC, it was possible to determine which of the following approaches was adequate for predicting the effects of changes on times taken to solve problem (t) and number of problems correctly solved (n).

Approach I ... Groups in a Given kind of network will exhibit differences when their antecedent conditions have been different. The directions of such differences depend on the centrality indices of the antecedent conditions:

(t) CW > (t) WW (n) CW < (n) WW
(t) WC < (t) CC (n) WC > (n) CC

Approach II ... Changes in patterns of communication will lead to better performances regardless of the centrality indices of the antecedent conditions:

(t) WC < (t) CC (n) WC > (n) CC
(t) CW > (t) WW (n) CW > (n) WW

Approach III ... It is the structures of the present communication patterns that serve to distinguish between the performances of problem-solving groups, rather than antecedent conditions or the changes themselves. This approach would be considered supported if the following results were to be obtained:

(t) WC = (t) CC (t) CW = (t) WW
(n) WC = (n) CC (n) CW = (n) WW

(t) WC + (t) CC > (t) CW + (t) WW
(n) WC + (n) CC < (n) CW + (n) WW

Approach III was supported. For both kinds of communication patterns (C and W) the structures of the present patterns and neither the different antecedent conditions nor the changes themselves served to distinguish between the performances of groups in such patterns. Circles took longer times to solve problems and had fewer correct trials than Wheels.

Additional (t) and (n) analyses were done for trials 46 - 60 (last fifteen trials) between WC and CC, and between CW and WW. The results were: (t) WC < (t) CC; (n) WC > (n) CC; (t) CW > (t) WW; (n) CW = (n) WW.

The results of the additional analyses, however, indicate that after a measurable learning period differences in antecedent conditions serve to distinguish between the time performances of groups in the following way: When a communication pattern has been anteceded by one with a higher centrality index, performances of groups in it are better than when the antecedent condition had had the same centrality index. When a communication pattern has been anteceded by one with a lower centrality index, the performances of groups in it are worse than when the antecedent pattern had had the same centrality index.

Microfilm $2.00; Xerox $6.40. 135 pages.

1. Harold J. Leavitt, "Some Effects of Certain Communication Patterns on Group Performance," Journal of Abnormal and Social Psychology, XLVIII (1951), 38-50.

SEX DIFFERENCES IN PERCEPTUAL TASKS IN RELATION TO SELECTED PERSONALITY VARIABLES

(L. C. Card No. Mic 59-3575)

David Martin Fink, Ph.D.
Rutgers University, 1959

Major Professor: Dr. Milton Schwartz

This study attempted to compare systematically certain personality dimensions as measured by the Minnesota Multiphasic Personality Inventory (MMPI), and performance on various standardized perceptual tests: Embedded Figures, Revised Paper Form Board, and Judgment of Lines. The point of view was taken that the lack of systematic uniformities relating to the findings in perception-personality relationships could best be explored through a network of correlations among the different standardized tests. An attempt was made to see if sex differences found to exist in various perceptual tasks appear to be related to differences in personality between men and women or to personality traits more commonly found within each sex.

Fifty-six (56) college women and forty-six (46) college men, all completing a year course in introductory psychology, ranging in age from 18 years 3 months to 27 years 3 months were studied. The two group tests were given at one sitting for each of the four classes, while the other two tests were conducted on an individual basis in a second sitting. In quantifying and comparing data, basic reliance was placed on certain selected correlational methods as well as analysis of covariance technique. An attempt was made to develop a scale within the MMPI to predict perceptual efficiency with embedded figures and which may in the future be shown to have significance for other types of perceptual tasks. The items for this scale, selected following an item differentiation analysis using Flanagan's Tables for evaluation, showed negligible predictive value.

The hypotheses in this study were only accepted in part. A significant sex difference was found to exist in only one of the perceptual tests, Embedded Figures. No sex differences in personality traits as measured by the MMPI and as was predicted in this study were found to exist. The data pointed out the importance of intra-sex differences rather than inter-sex differences. In personality-perceptual relationships, it was found that a highly significant relationship exists between scores on the

Psychasthenia scale of the MMPI and Embedded Figures. The prediction in regard to the Hysteria scale of the MMPI and Embedded Figures was not substantiated, nor were predictions in regard to these personality scales and the other two perceptual tests. A meaningful relationship was found to exist between score on the Interest Scale (Masculinity-Femininity) and performance on Embedded Figures. It would appear that the results of this study point out the fruitfulness of research possibilities with Embedded Figures in the area of perception-personality relationships.

In sum, the approach of this study was to investigate perception-personality relationships with a widely used personality inventory which was constructed and standardized on an empirical basis. In this manner, it was felt that perhaps objective, quantitative means could be developed as predictors of certain perceptual abilities and, conversely, that performance on a basic perceptual task might be a fairly reliable and valid indication of the subject's personality characteristics which could be useful as a group screening device. The results and conclusions were discussed in relation to their limitations and implications. The implications were viewed from both a theoretical and practical standpoint and integrated with past research on perception-personality relationships. In general, perhaps the main contribution of this experiment lies, not in the consistency and significance of the results, but in its implications for subsequent research: (1) in furthering understanding of the perceptual process and how it is influenced by personality characteristics; (2) in developing a scale to predict certain types of perceptual functioning; (3) in the use of a basic perceptual task as a personality indicator; and (4) in the suggestions and hypotheses made for further research.

Microfilm $2.00; Xerox $6.40. 135 pages.

DETECTION OF FAKING IN VOCATIONAL INTEREST MEASUREMENT

(L. C. Card No. Mic 59-3747)

Clifton Wellington Gray, Ph.D.
University of Minnesota, 1959

Adviser: Donald G. Paterson

Two methods to detect faked physician scores on the Strong Vocational Interest Blank were tried. Suppressor-variable scales (like the K scale of the MMPI) included items not keyed for physician. Obvious-subtle scales included items keyed for physician; they differed from Wiener's by being defined empirically rather than by judgments of their subtlety. The two kinds of scales were combined by the linear discriminant function (LDF).

Items were selected for keying which discriminated in various degrees between presumed honest and presumed faked Strongs in both of two reference groups: 278 applicants to medical school who had earlier taken the Strong for counseling; and 206 artificial fakers who each furnished a standard and a faked Strong.

Scales were cross-validated on two groups of artificial fakers. Seventy-nine students produced an honest and a faked Strong each; in a second student group in which a random half produced honest and the rest faked Strongs, 49 high honest and 94 high faked physician scores were found. "High" meant B-plus or A on physician.

The best suppressor-variable scale with 34 items correctly labelled 87% of the profiles in the correlated validation group; it scored 90% true positives, meaning fakers labelled as fakers, with a loss of 16% in false positives, meaning honest profiles mis-labelled "faked." In the second, uncorrelated validation group, where both the scale and its optimum cutting score were cross-validated, the best suppressor scale labelled 77% of all profiles correctly, with 82% true positives and 33% false positives.

The best obvious-subtle scale correctly labelled 95% of the correlated profiles, with 97% true positives and 7% false positives. In the uncorrelated second validation group, however, where the scale was cross-validated the second time and its cutting score the first time, the best obvious-subtle scale correctly labelled only 75% of the profiles, with 87% true positives and a loss of 47% false positives.

Honest-group and faking-group means ranged from .8 to 2.7 honest SDs apart. The best suppressor scale separated the correlated groups by two SDs, the uncorrelated groups by 1.4 SD.

Various combinations of variables were made with the LDF. Combinations of two, three, and four variables were made, drawing from the most valid and least correlated suppressor-O-S scales and age. This LDF combination with an un-cross-validated cutting score correctly labelled 79% of the uncorrelated validation profiles, with 79% true positives and 80% true negatives.

Insufficient subjects were available to cross-validate various modified cutting scores. For that reason it is not possible to say confidently whether the LDF combination adds anything real to the best suppressor variable alone.

Differences among scales were not great nor constant enough to resolve the psychometric problems they represented of how lenient or severe the standards should be in selecting items from a pool and in defining reference groups. However, the data tend to support lenient standards.

The faking detectors developed here, though not recommended for use, are believed to warrant further validation.

Microfilm $4.20; Xerox $14.00. 325 pages.

NEGATION AND RELATED LEVELS OF DEFENSIVE VERBAL BEHAVIOR

(L. C. Card No. Mic 59-3464)

Warren Thomas Hill, Ph.D.
Boston University Graduate School, 1959

Major Professor: Henry Weinberg

Theory

Modern psychoanalytic theory has been primarily concerned with ego functions. Negation is thought to be one of the most basic ego functions. Freud first introduced the concept in 1915 with his paper, "The Unconscious", and then further developed it in his paper entitled "Negation" in 1925. R. Jones and Spitz have both made recent theoretical contributions that serve to clarify and extend the meaning of the concept.

Basically, negation, as a thought mechanism, serves adaptation by allowing a repressed or inhibited idea to enter consciousness to be used for consciously acceptable purposes, on the condition that the idea is consciously disbelieved. The mechanism of negation tends to allay the painful affect or anxiety that is connected with an unacceptable idea.

R. Jones, Slack, and Grieve have attempted to invoke a negation response set in an individual and broadly predict the nature of his responses to the Word Association Test, the Thematic Apperception Test, and also to interviews. Results were all consistent with the concept of spontaneous negation. But there remained the question of whether or not the concept of negation was the most parsimonious explanation. The present study was designed in such a way that negation would best explain the predicted results.

Hypotheses

Three hypotheses were generated from the concept of spontaneous negation.

The first hypothesis stated that the response probability of painful verbal material that is associated with the defense mechanism of simple inhibition under an invoked affirmation set will increase when the invoked affirmation response set is altered to that of an invoked negation set.

A second hypothesis stated that the response reaction time of inhibited painful material should decrease with the altered set.

A third hypothesis stated that there would be individual consistency in defensive operations on ascending levels of psychic organization. That is, individuals who tend to inhibit painful material under affirmation (low level defense), will tend to negate the material under negation (higher level defense), and will tend to evidence general defensive thinking (highest level defense) by an independent measure.

Design

Each subject was asked to complete a forty-seven item inventory that included the K scale of the MMPI and the Bendig form of the Taylor Manifest Anxiety scale. General defensive thinking was defined as an elevated score on the K scale.

Each of 48 subjects learned two lists of six nonsense syllables to an identical criterion. One list was then associated with 30 electric shocks as the subject wrote the list 15 times. The other list had no shock while being written 15 times. Painful and neutral verbal material were defined as syllables associated with shock and syllables not associated with shock.

Twenty-four hours later the subject was exposed to an autokinetic (stationary) light, and informed that the experimenter was going to move the light through space and write syllables from the list of twelve syllables that were learned the day before. The subject was asked to respond with the syllable that was being written with the light on each of 20 trials (affirmation response set). Each subject was then asked to respond with a syllable that definitely was not being written on each of 20 trials (negation response set).

Results

The first hypothesis was supported with little room for doubt. The second hypothesis barely missed a conventional level of confidence, but other evidence tended to provide added support for this hypothesis. The third hypothesis was also supported.

The general implication of the results is that an invoked negation set tends to allow ordinarily inhibited painful verbal material to enter consciousness. In addition there is consistency in defensive verbal behavior on different levels of mental organization.

Microfilm $2.45; Xerox $8.60. 187 pages.

A STUDY OF CHILDREN'S MORAL JUDGMENTS

(L. C. Card No. Mic 59-3751)

Ronald Charles Johnson, Ph.D.
University of Minnesota, 1959

Introduction: Professor Jean Piaget's studies of children's moral judgments showed that an age change occurred in moral judgment. Young children believe in immanent justice, moral realism, retributive punishment, and in the efficacy of severe punishment, while older children, but not children of a middle age range, believe in communicable responsibility. Piaget attributed these age changes to increased peer cooperation, decreased adult constraint, and qualitative intellectual changes in the child.

Problem: The primary purpose of this study was to determine the degree of consistency between responses to questions in the areas of moral judgment cited above. The secondary purpose of this study was to determine the relationship of various antecedent conditions to moral judgments.

Design and Sampling: A set of twenty moral judgment questions was devised. Naive judges successfully categorized the questions into the areas of moral judgment they were designed to measure. Published tests of parent attitudes and of abstractness and concreteness were used in an attempt to measure the influence of two of the three factors Piaget believed most significant in producing changes in moral judgment.

The sample consisted of 809 subjects in grades 5, 7, 9, and 11 in a Midwestern city. Subjects approximated national urban norms in parental occupation and in I.Q. The moral judgment test was administered to all subjects. The test of abstractness-concreteness was administered to sub-samples in grades 7, 9, and 11. Parents of subjects in these sub-samples responded to the parent attitudes test. Test and normative data were analyzed.

Results: The moral judgment test had a reliability of approximately .60 at each age level. Correlations between moral judgment questions revealed far more positive and significant relationships than chance expectancy. Responses within moral judgment areas (e.g., moral realism) were nearly always positively and significantly correlated. Correlations of the number of mature responses in the various areas of moral judgment showed response tendencies in the areas of moral realism, retribution vs. restitution, and the efficacy of severe punishment to be rather closely related. Responses to immanent justice questions were less closely related, while responses

to questions involving communicable responsibility were essentially unrelated to other response tendencies.

Neither abstractness nor concreteness were related to moral judgments once I.Q. was partialled out. Parent attitudes were significantly related to moral judgments, especially in the areas of immanent justice and communicable responsibility. I.Q., and to a lesser extent, parental occupation were positively and significantly correlated with mature moral judgments, especially in the areas of moral realism, retribution vs. restitution, and efficacy of severe punishment. Age was positively and significantly correlated with mature moral judgment in all areas.

Conclusions: Correlations within moral judgment areas show a high degree of positive association; correlations between moral judgment areas (except for communicable responsibility) showed considerably greater association than would be expected by chance. Most findings having to do with the correlations of responses to moral judgment questions are in the direction suggested by Piaget. Obtained correlations are lower than would be expected from his analysis, perhaps because the test of moral judgment is not sufficiently reliable. Factors measured in this study that Piaget believed influential in producing change in moral judgment seemed of relatively slight significance, I.Q. being the most significant. The present study thus does not generally support this aspect of Piaget's theory.

Suggestions for Further Research: Further research might best be aimed at determining the relationship of various aspects of moral judgment to specific behaviors; for example, neurosis, progress in therapy, delinquency, and authoritarianism. The study of moral judgment may be found to have practical as well as theoretical importance. Microfilm $2.60; Xerox $9.00. 197 pages.

THE RELATIONSHIP AMONG SOME MEASURES OF PREFERRED INTEREST, VOCATIONAL OBJECTIVES AND ACADEMIC PERFORMANCE

(L. C. Card No. Mic 59-3845)

Paul Anthony Lane, Ph.D.
Tne University of Connecticut, 1959

Purpose of the Study

This study was an attempt to treat with one area of motivation posited as relating to the performance of college students, this being the relationship between patterns of vocational interest and college performance. The major objective of this study was to determine whether, and to what degree students interests could be used to predict their subsequent academic status. The main hypothesis of this study was: when students are grouped by stated vocational goals, those students designated as Achievers will be revealed as having a distinguishing pattern of interests, and more self knowledge of interest, as compared with students designated as Nonachievers. Achievers in this study were those students whose scholastic grades were of such quality that they were permitted entry into the junior year of college. Nonachievers in this study were those students whose scholastic grades were of such quality that they were not permitted entry into the junior year of college.

Research Procedures and Techniques

The subjects of this experimental study were the entire Freshmen class matriculating at the University of Connecticut in the fall of 1954. The Freshmen class of 1954, consisted of 1,641 students, 991 males and 650 females. These students were randomly assigned to the experimental groups. The level of their intelligence was considered sufficient to allow them to complete the requirements leading to a baccalaureate degree. The basic design of this study can be described as a split plot design with subjects being placed in their respective groups by random methods. The subjects of this study were required to fill out a Vocational Questionnaire and the Kuder Preference Record. The data resulting from the application of these two instruments were used in the following manner:

1. The females were grouped into nine vocational groupings. The males were grouped into twenty vocational groupings.
2. Each vocational grouping was then subdivided according to the academic criterion into an Achiever and a Nonachiever subgroup.
3. The mean interests of each Achiever and Nonachiever group were determined for each of the ten Kuder areas of interest.
4. The significance of the difference between the mean of the Achievers and the mean of the Nonachievers was then computed for each area of interest.
5. Whenever a significant difference occurred, a relevant cutoff percentile was set up ten percentile points from the mean of the Achievers and in the direction of the mean of the Nonachievers.
6. This procedure resulted in four or more cutoff points for twenty-eight out of twenty-nine of the vocational groups.
7. Using the cutoff percentiles termed 'critical' for success in pursuing an occupation, the interest scores of each student were reviewed individually without knowledge of the student's eventual academic status, and an attempt was made to predict his later status as either an Achiever or a Nonachiever.

Findings

Through the use of the above procedures it was possible through a blind analysis of students' interest scores to predict the eventual status of approximately three out of four students involved in this study.

Microfilm $2.30; Xerox $8.20. 176 pages.

PERCEPTION OF WORK PERFORMANCE BY WORKERS AND SUPERVISORS

(L. C. Card No. Mic 59-3469)

James Taylor Mahoney, Ph.D.
Boston University Graduate School, 1959

Major Professor: Henry Weinberg

Background and Purpose

Work performance is an area of major interest for psychologists in their study of human behavior. The present study will investigate two important problems in this area. Phase I is concerned with criterion development. It is postulated that the bases which supervisors utilize in judging work performance are dependent upon the occupational group of which they are members as well as membership in the supervisory group, i.e. that membership in these groups to some extent determines the direction which supervisory expectations take with respect to work performance. It is hypothesized that the consistency of performance expectations of supervisory judges is a function of the homogeneity of the groups from which these judges are drawn. Derived from this general hypothesis are two specific hypotheses to be tested:

> Hypothesis #1 - The performance expectations of supervisors will be significantly more consistent than of non-supervisors.
>
> Hypothesis #2 - The performance expectations of supervisors within homogeneous occupational groups will be significantly more consistent than among supervisors who are occupationally heterogeneous.

The second general question, considered in Phase II, concerns the congruence of worker-supervisor performance expectations. A positive relationship is postulated between the degree of congruence of the expectations of worker and supervisor and the evaluation by the supervisor of the individual worker's performance.

> Hypothesis #3 - The ranking by a supervisor of worker performance is a function of the degree of congruence of worker-supervisor performance expectations.

Instrument Employed

A special instrument, the Performance Assessment Scale or PAS, was constructed to measure the effects under study. The scale is designed to minimize social desirability factors. The scale consists of fifteen groups of statements describing work behavior. The subject is asked to rank the five statements in such a way that they reflect order of importance for effective job performance. In this way, a measure of his performance expectations is obtained.

Statistics

For Phase I, the Coefficient of Concordance was utilized to measure consistency of expectations within groups of subjects. The values for this statistic were then transformed and placed in a Random Blocks Design.

For Phase II, a congruence score for each worker was obtained by squaring the deviations of his rankings of the PAS statements from the supervisor rankings. These scores were then correlated to the ranking by the supervisor of the workers' performance by means of the statistic tau.

Results

Hypothesis # 1 - 151 supervisors from widely disparate occupations were found to agree significantly more in their rankings of the PAS statements than 49 non-supervisors. An F of 8.51 was obtained. This is significant beyond the .05 level.

Hypothesis #2 - Of fifteen groups of occupationally homogeneous supervisors, eleven agreed in their rankings to a significantly greater extent than did the group of 151 supervisors of heterogeneous occupational background. Values of F for these eleven groups ranged from 11.33 to 252.13. Under the conditions of this study an F greater than 8.86 is significant beyond the .01 level.

Hypothesis #3 - The variable, congruence of expectations, was found to be related beyond the .05 level to supervisor rankings of workers in two out of the four groups tested.

It is interesting to note that none of the individual groups used to test the above hypotheses showed results which were contrary to prediction.

Conclusions

1. Membership group appears to be significantly related to the degree of consistency among judges in their evaluation of work performance.

2. The evaluation by a supervisor of the overall performance of an individual worker is positively related to the degree of agreement between their performance expectations.

3. It would seem that cognizance of performance expectations is necessary in the understanding and refinement of criteria of worker performance.

4. Performance expectations may represent a promising new area of research upon the communication process between worker and supervisor.

Microfilm $2.35; Xerox $8.20. 180 pages.

THREE CURRENT CHILD DEVELOPMENT THEORIES APPLIED TO CHILD CARING TASKS. A STUDY OF THREE CHILD DEVELOPMENT THEORIES AS POSTULATED BY JEAN PIAGET, ERIK H. ERIKSON AND ROBERT R. SEARS FOR THE PURPOSE OF APPLYING PRINCIPLES DERIVED FROM THESE THEORIES TO CHILD CARING TASKS IN CHILDREN'S INSTITUTIONS.

(L. C. Card No. Mic 59-3758)

Henry William Maier, Ph.D.
University of Minnesota, 1959

This exploratory theoretical research project establishes a range of pertinent child-caring propositions and principles in relation to previously established child-caring tasks. All of Jean Piaget's, Erik H. Erikson's and Robert R. Sears' work have been integrated separately. Each one

is presented as a distinct developmental theory, with a summary of the basic assumptions underlying the respective theories. A brief biographical sketch supplements all three.

Jean Piaget's writings, an 'embryology of intelligence,' analyze intellectual development as continuous, dynamic change which proceeds in well-defined patterns to a logical, balanced system of cognitive behavior at maturity. This orderly process reveals five successive developmental phases. The higher level originates at a less complex and more concrete level of thinking. Piaget introduces definite laws of intellectual development which can be utilized in the understanding, diagnosis, training and education of the child.

Erik H. Erikson's writings and lectures stress socio-emotional development. His theory must be first understood in its totality. Emotional development depends largely upon the creative opportunities each individual realizes in mastering his inner drives and environmental opportunities. It is the quality of the ego experience which is most significant, particularly the experiences related to the unique crisis in each of the eight developmental periods.

Each crisis provides opposing pulls which must be resolved, at least in part, before an individual can effectively face the next phase. Every new developmental acquisition has its roots in a previous phase. Any one specific behavioral pattern has neither a real beginning nor a real end.

Robert R. Sears' writings are related to the behavioral expressions of the growing individual — the impact of environmental forces. Development means a constant increase in the capacity to absorb and to evoke more complex behavioral events. The dyadic interactions between the growing individual and his caring adult(s) creates distinct balances of secondary motivational systems. These new motivational forces become critical variables for child-rearing and consequently for influencing a child's development. Development depends largely upon the motivation for dependency and opportunities to be on one's own upon the motivation to accept control and to agress; that is, to behave as the immediate social environment wills and permits.

Eight ranges of child caring tasks with distinct sub-units have been established as part of the second research focus. These child-caring tasks have been derived from the descriptive material and expectations of the current literature on child-caring institutions. These tasks describe the actual activity (the content of child caring) in an orderly sequence proceeding from the simple to the complex, from single to multiple inter-related actions and from actively doing and sharing to teaching and interpretation.

The concluding chapter provides a frame of reference of guiding propositions and principles which have been deduced from an integration of the three child-development theories. The child-caring propositions provide the basic direction for the application of the subsequent child-caring principles. These principles are correlated to the eight categories of child-caring tasks. They are presented within the five basic levels of development. Together they form a frame of reference. They are written in simple, non-technical language in order to serve, after a diagnostic appraisal of each child-caring situation, as an applicable guide in the day by day child care in an institutional program.

In summary, the three theories define why a child behaves as observed. The tasks establish what efforts are involved within an insttitutional setting. The child-caring propositions and principles direct how these tasks might be carried out after the child's developmental level has been appraised (diagnosed) within each particular child caring situation.

Microfilm $5.20; Xerox $18.40. 407 pages.

SOME RELATIONSHIPS BETWEEN PERSONALITY AND HUMOR

(L. C. Card No. Mic 59-2647)

Allyn F. Roberts, Ph.D.
Michigan State University, 1958

Humor, a topic of considerable philosophical speculation throughout the ages, has until recently been an area much neglected by the psychologist. Though humor may be the most common form of emotional expression in our culture, there have been few scientifically designed experiments aimed at exploring the relationship between humor and personality.

The present study is an outgrowth of the theorizing of Freud and George H. Mead on humor. A consideration of their remarks led to the formulation of three hypotheses stating relationships between personality variables and the appreciation of humor.

Twenty-five hospitalized male adults diagnosed as psychoneurotic and twenty-five nearly recovered male adult tuberculosis patients served as the subjects of the study. A series of thirty-five cartoons representing seven distinct themes was presented to the subjects for rating. Two measures of humor appreciation were derived from the responses: (1) a verbal funniness score, derived from each subject's ratings of the cartoons on a seven point scale of funniness, and (2) the number of laughs and smiles. These measures were compared with three personality variables: general adjustment level, amount of tension in the cartoon theme areas, and role-taking facility.

The first hypothesis involved a comparison between the humor appreciation measures and three ways of defining psychological adjustment: (1) the absence of severe psychopathology, (2) high ego strength on the Barron scale, and (3) the absence of strong tensions. Significant relationships were found between the absence of psychopathology and both humor appreciation measures, between scores on the Barron Ego-Strength Scale and the verbal funniness ratings for the subjects of both groups, and between the ego strength score and the number of laughs and smiles for the neurotic subjects. The third comparison between the tension score and the humor appreciation measures yielded significant results among the neurotics but not the T.B. subjects. Although Freud and others have emphasized the importance of humor in adjustment, this study represents one of the few experimental approaches to this topic.

The second hypothesis involved comparisons between the liking of cartoons dealing with specific themes and the presence of tension in these same theme areas. Significant relationships were found between neurotics' liking of humor dealing with self-aggrandizement, hostility, facing unpleasant situations, heterosexuality, and the presence of higher tension in these areas. None of these correlations was significant for the comparisons involving the T. B. group.

The test of the third hypothesis did not support Freud's and Mead's contention of a positive relationship between humor appreciaton and role-taking facility. No significant relationships were found for these comparisons.

The findings of this study are consistent with Freud's assertion that humor can serve the individual as a mechanism for dealing with tensions and problems in a positive way. The main purpose of this investigation was to explore this idea. In general, the present results showed that persons who were able to use and enjoy humor the most scored highest on the adjustment measures.

Microfilm $2.00; Xerox $5.80. 118 pages.

THE RELATIONSHIP BETWEEN PARENTAL COMMITMENT AND CERTAIN FORMS OF DEPENDENT BEHAVIOR

(L. C. Card No. Mic 59-3963)

Alan Hardy Townsend, Jr., Ph.D.
University of Michigan, 1959

This study has attempted to investigate factors underlying the development of over and counter-dependent behavior. Dependence is seen as an important issue at the social as well as the interpersonal level. It is of particular importance in parent-child, student-teacher, and therapist-patient relationships. Dependency is considered a basic aspect of personality development and therefore, attempts to understand various forms of dependent behavior must deal with developmental factors.

Some general theoretical formulations were offered to explain the development of over and counter-dependent behavior. The formulations dealt with the interaction between two variables, the mastery drive and parental commitment. The mastery drive is viewed as one of the basic drives comparable to the sexual and aggressive drives. It arises in the early months of life as the infant first begins to develop need satisfying resources. At this point it becomes intrinsically more satisfying for the infant to satisfy his needs on his own than to rely on the help of others. Whether this drive becomes inhibited or overvalued during the course of its development depends on the level of parental commitment.

Parental commitment refers to the helping aspects of parental behavior. The level of commitment refers to the amount of resources a parent provides to the child. From the considerations of the effects of commitment on the development of the mastery drive the following major hypotheses were derived:

Hypothesis 1 - Levels of commitment, as they deviate from a maximal level during the initial stages of the development of the mastery drive, will produce anxiety and conflict in the child in the area of independence-dependence, the amount of which will vary directly with the degree of variation from maximal commitment.

Hypothesis 2 - During the later stages of development of the mastery drive a rate of relinquishment of commitment which is faster than the optimal rate (undercommitment) will be associated with counter-dependent behavior, and a rate slower than optimal (overcommitment) will be associated with over-dependent behavior.

Measures of over and counter-dependent behavior and of parental commitment were devised in order to test these hypotheses. The over-dependency measure was a projective test battery consisting of six incomplete stories and two ambiguous pictures. On the basis of this test three groups of children were isolated, over-dependent, counter-dependent, and neutral. Five measures of commitment were devised and incorporated in an interview administered to mothers. These measures were employed in an extensive pilot study and the results were in essential agreement with the main study.

In the main study data was collected on forty-two child-parent pairs. In addition to testing the relationship between dependency and parental commitment, the study also explored the relationship between dependency and intelligence, need achievement, social class, and various sibling relationships.

The results of the study confirmed both of the major hypotheses. The one prediction derived from the first hypothesis was confirmed, and four of the six predictions derived from the second hypothesis were also confirmed. Significant results were obtained with three of the five measures of parental commitment. It was concluded that the results did lend support to the theoretical formulations. In addition, conclusions were drawn as to the differential behavior of the mothers of the three groups of children.

The implications of the study in the area of child-rearing in psychotherapy were discussed. Additional research in the area of ego development, ego strength, and the differences in commitment behavior experience by boys and girls, was suggested.

Microfilm $2.00; Xerox $6.40. 131 pages.

PSYCHOLOGY, CLINICAL

THE RELATIONSHIP BETWEEN MOTIVATION AND PERFORMANCE IN ACHIEVING AND UNDERACHIEVING COLLEGE STUDENTS

(L. C. Card No. Mic 59-3450)

Gene L. Bocknek, Ph.D.
Boston University Graduate School, 1959

Major Professor: Chester C. Bennett

This study was designed to test certain aspects of motivation theory as they apply to academic achievement. The study focussed on the prediction of college achievement from students' performance under specified conditions of motivation.

A theoretical formulation of the experiment was adduced from the literature. The theory states that an individual is motivated to the extent that his needs are unsatisfied. Striving for need satisfaction will not occur, however, unless sources of satisfaction (i.e. incentives) are present. Incentives may arise within the individual as intrapersonal incentives or they may be provided by the environment as situational incentives. Predominance of one form of incentive implies subordination of the other form of incentive. Academic achievement in college places maximum emphasis on intrapersonal incentives (e.g. desire for knowledge) and offers few situational incentives (e.g. grades).

The individual with strong achievement needs (i.e., need to compete with a criterion) seeks and depends upon situational incentives. Consequently, the behavior of achievement-motivated individuals is a function of situational achievement incentives. The behavior of individuals who are relatively free of achievement motivation is relatively independent of achievement incentives.

Since college study offers few situational achievement incentives, students with strong achievement needs (i.e., those whose performance is increased by achievement incentives) will tend to be academic underachievers. Students whose performance is independent of situational incentives will tend to be academic achievers.

The major hypothesis of this investigation states:

Response to achievement incentives is inversely related to academic achievement status.

A second hypothesis and two corollaries are also derived:

Performance is a function of the interaction between incentive conditions and academic achievement status.

Performance of academic underachievers is a function of incentive conditions.

Academic achievement status was defined by the difference between point-hour ratio (PHR) predicted from a scholastic aptitude test (The Ohio State Psychological Examination) and PHR attained at the conclusion of the first semester at college. Students whose attained PHR was .65 or more below predicted PHR were classified underachievers (N = 44). Students whose attained PHR was not more than .35 below predicted PHR were classified achievers (N = 53). Fourteen students who were in the intermediate range were included in the test of the major hypothesis. All the testing was conducted prior to the school year. Subjects were not classified until the end of the first semester.

An arithmetic additions task was selected for the performance measure. Incentive conditions were manipulated by varying the instructions. The neutral condition was defined by introducing the task as a practice period. The incentive condition was defined by instructions that the second half of the task was an aptitude test measuring success potential. Significantly higher scores on the latter half of the task support the assumption that the procedure was experimentally valid.

The major hypothesis and the two corrollary hypotheses were statistically confirmed. The second hypothesis did not yield statistically significant differences. Further analysis revealed that the achiever group contained a subgroup of overachievers, students whose attained PHR was significantly greater than predicted PHR and who showed a significant increase in performance with incentives.

The results are in general conformity with the proposition that response to achievement incentives is inversely related to academic achievement status. Further analysis indicates, however, that this is an incomplete formulation. Attention is called to the relevance of variables such as motive intensity and conflict status of the motive. Future studies should investigate the effect of these variables in order to arrive at a more precise explication of the relationship between motivation and performance.

Microfilm $2.00; Xerox $4.20 79 pages.

SELECTIVE RECALL OF TASKS IN RELATION TO MANIFEST ANXIETY, RECALL ORIENTATION, AND FOREWARNING OF COMPLETION OR INCOMPLETION

(L. C. Card No. Mic 59-3994)

Jacqulyn Starken Clements, Ph.D.
Indiana University, 1959

In some studies concerning the selective recall of completed and incompleted tasks, some tasks are not completed because the subject is interrupted by the experimenter. In other studies, some tasks are not completed because they are very difficult or unsolvable. In the latter situation, it appears that the subject man be forewarned of completion or incompletion. Such forewarning might permit differential reactions to the two types of tasks during performance which could affect later recall. Many studies in this area have used ego versus task oriented instructions prior to task performance, but the orientation prior to the recall of tasks has not been investigated. Also, while attention has been given to the effects of anxiety occurring with stress-producing instructions, subjects have not yet been selected directly on the basis of an anxiety scale. The present study will deal with some of these unexplored factors.

Forty-eight subjects, seen individually, did 16 tasks, approximately half of which were completed. Each task was a category (such as vegetables) for which the subject was asked to write examples (such as corn) in a one minute time limit; examples containing the letter i were not allowed. There was a 10 second pause during performance and a 10 second delay between categories. Later the subject was asked to recall the names of the categories. The subject was told that he must complete a category in order

to receive credit. In order to complete a category, the subject had to write at least as many examples as a "norm" score. The experimenter gave "obtainable" norms for half the categories and "unobtainable" norms for the other half. Prior to the experiment, each subject had been scored on Taylor's Manifest Anxiety Scale and designated as high, high medium, low medium, or low anxious.

There were six distinct experimental groups. Four groups received ego oriented performance instructions while two groups received task oriented performance instructions. Two of the ego oriented performance groups were given the norm scores following performance on each task; the remaining four groups were given this norm information during the pause in performance. In the three pairs of groups with identical performance orientation and point of norm information, one group was given ego oriented recall instructions and the other group was given task oriented recall instructions. There were eight subjects in each of the six treatment groups: two from each anxiety level.

Results showed that the high anxious subjects recalled more completed than incompleted tasks while the low anxious subjects recalled more incompleted than completed tasks. There was a significant direct relationship between anxiety and the recall of completed tasks and a non-significant inverse relationship between anxiety and the recall of incompleted tasks.

The groups with norm information during performance tended to recall more completed tasks while the groups with norm information after performance tended to recall more incompleted tasks. In addition to the possibility that differential reactions to completed and incompleted tasks occurred with forewarning, it was hypothesized that receiving norm information during performance may have increased anxiety.

There was an interaction effect on selective recall of point of norm information and recall orientation. For groups with ego oriented recall instructions, norm information during performance significantly increased selective recall; for groups with task oriented recall instructions, norm information during performance tended to decrease selective recall.

Neither treatment nor anxiety level affected the recall of incompleted tasks; however, three factors appeared to increase the recall of completed tasks: high anxiety as determined by the anxiety scale, norm information during performance, and similarity of performance and recall orientations (both "ego" or both "task").

Microfilm $2.00; Xerox $4.60. 88 pages.

JUDGMENTS OF INTELLECTUAL LEVEL FROM VARIOUS FEATURES OF THE RORSCHACH INCLUDING VOCABULARY

(L. C. Card No. Mic 59-4064)

Hannah Susan Davis, Ph.D.
Columbia University, 1959

The aim of the study was to determine whether experienced psychologists could judge intelligence from three kinds of protocols from the Rorschach technique: the total Rorschach record, the profile of scores and ratios, and the vocabulary used in responding to the inkblots.

The following hypotheses were developed to investigate the problem.

1. The level of intellectual functioning can be estimated with accuracy significantly better than chance from (a) the total Rorschach record, (b) the Rorschach profile, or (c) the vocabulary used in the Rorschach record.
2. The level of intellectual functioning can be estimated more accurately from the total Rorschach record than from either the Rorschach profile alone or the vocabulary level alone.
3. The level of intellectual functioning can be estimated more accurately from the Rorschach profile than from the vocabulary level.

The Stanford-Binet was administered to a sufficient number of subjects between the ages of 16 and 25 to obtain a sample of 70 whose IQ's were rectangularly distributed, 10 in each interval from 40-49 to 100-109. Individuals with known psychopathology other than mental deficiency were excluded.

The Rorschach, administered soon after the intelligence test, was tape recorded. From the verbatim record, the profile and vocabulary lists were prepared.

A period of preliminary training and investigation of agreement for the three judges, all trained psychologists, preceded the study. They judged sample protocols until their estimates of 10 records showed correlations significant at the .01 level and no significant differences in means.

In the main study each psychologist judged intelligence from the total records of one-third of the subjects, from the profile of a second third, and from the vocabulary lists of the remaining third.

Correlations between the judges' estimates and IQ's and partial correlations between the total record judgments and IQ's, with the other relationships held constant, supported the first hypothesis and part of the second, but failed to support the other part of the second and the third. The estimates on all material showed a better than chance relationship with IQ, but estimates from the total record and vocabulary showed a significantly greater relationship than did those from the profile. The partial correlations indicated that vocabulary contributed substantially more to the total record estimates than did the profile.

Although the mean IQ did not differ significantly from the means of the estimates, comparisons within intervals revealed serious discrepancies.

According to the results either the Rorschach record or appraisal of expressed vocabulary, a less laborious technique, can be used as a screening device for groups. The fact, however, that the correlations between estimates and IQ, although significantly high, account for only 50% or less of the variance, and the observation that many cases were greatly misjudged, suggest that none of the material studied can be used for valid prediction of intelligence in individual cases.

Microfilm $2.00; Xerox $3.80. 70 pages.

A COMPARATIVE STUDY OF THE EXPERIENTIAL CHARACTERISTICS OF A GROUP OF ALCOHOLIC AND NON-ALCOHOLIC SUBJECTS

(L. C. Card No. Mic 59-4255)

Hugh Chester Davis, Jr., Ph.D.
The University of Tennessee, 1959

Major Professor: G. R. Pascal

This investigation makes behavioral comparisons between a group of male workhouse alcoholic individuals with a matched group of non-alcoholics. The purpose of these comparisons was to generate hypotheses about the nature of alcoholism. Alcoholism, the criterion of the study, was defined behaviorally. All data used in this study were obtained from the Subjects through standard clinical interviews. The interviews were organized in behavioral case histories.

Two independent judges, using the case history data, rated all Subjects on fifty-six behavioral variables and a scale of environmental deprivation, with both the variables and the deprivation scale pertaining to how the Subjects presently function in their environments. Ratings also were made on the Subjects' first decade of life using the Pascal-Jenkins Behavioral Scales. These scales pertain to the kind of stimuli the Subjects encountered during this period of their lives. Nonparametric statistical analysis was made on each variable to determine if the alcoholic and control groups were significantly different on the variables.

The cross-sectional variables were grouped a priorily into four behavioral categories: Occupation, Physical Habits, Interpersonal Relations, and Non-Occupational Activities. Analysis of composite ratings by categories yielded significant differences between groups for each category. Individual analysis of behavioral variables comprising the categories showed forty-eight percent of them to be significant between groups. The alcoholics also were found to be experiencing greater environmental deprivations than the non-alcoholics. Analysis of Pascal-Jenkins Behavioral Scales, on the Subjects' first ten years of life, showed significant group differences on forty-seven percent of the variables comprising these scales.

Of particular note was the alcoholics' inadequate interpersonal relationships, manifest in behavioral extremes. The alcoholics' current functioning seems related to their having experienced in childhood stimulus situations having greater deprivations of contact with significant people, as well as a specific attribute of contact as less affection. A discussion of how alcohol, a depressant, serves possibly to reduce stimulation levels exceeding those encountered by the alcoholic Subjects during their childhood.

Microfilm $2.00; Xerox $5.40. 110 pages.

THE PERFORMANCE OF DELINQUENT AND NON-DELINQUENT BOYS ON THE TENNESSEE DEPARTMENT OF MENTAL HEALTH SELF-CONCEPT SCALE

(L. C. Card No. Mic 59-3998)

John Howard Deitche, Ph.D.
Indiana University, 1959

The problem under investigation was the comparison of self-concept ratings of two groups of boys, one group adjudged delinquent and the other non-delinquent. The bases of comparison were three dimensions of self and five frames of self which the individual ascribed to himself by checking the Tennessee Department of Mental Health Self-Concept Scale.

To assess the extent to which the scale yielded behavior parameters or self-concept constellations which were in substantial agreement with previous theoretical and experimental expectations, the following hypotheses were formulated and tested:

1. The mean self-concept scores of delinquent boys would be significantly different from the mean self-concept scores of non-delinquent boys.
2. The mean self-concept scores of non-delinquent boys would be higher, that is, more positive, than the mean self-concept scores of delinquent boys.
3. Non-delinquent boys would be more consistent in terms of their self-concept than delinquent boys.

Methods and Procedures

The delinquent group was composed of 50 white, 15 and 16 year old males, who had been apprehended because of antisocial acts and interned at the Father Gibault Home for Boys.

The non-delinquent group was chosen from among the general public school population and was matched with the non-delinquent group on the following four variables: 1) age, 2) intelligence, 3) ethnic origin, and 4) stability of the home.

The two groups were tested in their respective schools during school hours. The self-concept scale was group-administered; ten subjects from the same group taking the test at one time. Identical directions and procedures were used at each administration.

Findings and Conclusions

Analysis of the results of the study permitted the following conclusions:

1. The self-concept scores significantly differentiated subjects with different social behavior patterns, i.e., delinquents and non-delinquents, on the basis of total mean positive scores. The data, then, supports hypothesis I and suggest that the delinquent and non-delinquent boys were drawn from different populations having different self-concept structures.
2. When the non-delinquents were compared with the delinquents, five out of the eight not positive scores were significant at the .05 level or better. Hypothesis II was supported and suggested that the magnitude of positive self-concept scores had some relationship to adjustment when delinquents were compared with non-delinquents.
3. There was no significant statistical difference in the consistency scores of the two groups, delinquent and

non-delinquent boys. Therefore, on the basis of the data presented, hypothesis II was rejected.

Microfilm $2.00; Xerox $4.80. 92 pages.

THE DEVELOPMENT OF TWO FAMILIES OF DEFENSE

(L. C. Card No. Mic 59-3922)

Virginia Isabel Baker Douglas, Ph.D.
University of Michigan, 1959

This dissertation was concerned with children's reactions to frustration and conflict. Three kinds of reaction were studied. Two of these are examples of the psychoanalytic concept of defense mechanism. The third is a non-defensive reaction in which the child demonstrates the ability to cope with frustration and conflict by using realistic problem-solving techniques.

The hypotheses of the investigation were derived from some of the more common assumptions which psychiatrists and psychologists make regarding the defense mechanisms. The study was based on a particular classification system developed in the Socialization Project at the University of Michigan to provide a theoretical structure for research on defense mechanisms. In that system, the mechanisms are classified into families or types on the basis of three criteria. The criteria include complexity, degree of distortion, and social effectiveness, and are closely related to such terms as "maturity" and "adaptiveness" which clinicians use to evaluate the various mechanisms of defense.

Two defenses were studied which represent opposite extremes on each of the three criteria. They are denial, which is classified as a defense of the first family, and minor distortions of affect, which are included in the third family of defenses. As described in the classification system, defenses like denial require simple skills, involve major distortions of events, and tend to create social difficulties for the person using them. Clinicians, too, view denial as an "immature" and "non-adaptive" defense. Defenses involving minor distortions of affect, on the other hand, require complex skills, produce only minor distortions, and are likely to be socially rewarded.

The following hypotheses were derived from the conceptual approaches elaborated above. It was predicted that denial, a defense of the first family, would be negatively related to age, intelligence, and sociometric status. It was also predicted that minor distortions of affect and non-defensive reactions would have positive relationships with age, intelligence, and sociometric status.

Two samples of subjects were studied. The first consisted of 116 children from grades three to ten in the University Schools in Ann Arbor. Most of these subjects were of superior intelligence and came from upper-middle class homes. The second sample consisted of 62 children, all in grade five, and from three different public schools in Grand Rapids, Michigan. The working class was well represented in the second sample, and the majority of the children were of average intelligence.

Defensive and non-defensive reactions were studied by means of the story completion technique. The subjects made up endings to six stories, each of which portrayed a frustrating episode in the life of a child.

Most of the obtained correlations supported the hypotheses. In all cases, significant relationships were obtained between age and the defensive and non-defensive reactions. The hypothesized relationships between defense and intelligence were larger in the Grand Rapids sample than in the sample from Ann Arbor. In the case of the predicted relationships between sociometric status and defense, it was also found that the obtained correlations were higher in the Grand Rapids sample. The only exception was provided by the defense of denial which produced higher correlations for the Ann Arbor sample. The differences in magnitude of correlations obtained from the two samples may be explained by a number of possible factors. They include dissimilarities in ranges of age, in socio-economic status, and in intellectual capacity in the two samples.

On the whole, the results support the utility of the classification system on which the study was based. They also support some of the more common assumptions about the defense mechanisms made by psychiatrists and psychologists.

Microfilm $2.00; Xerox $7.00. 147 pages.

A STUDY OF ANXIETY IN CHILDREN WITH RHEUMATIC FEVER: THE RELATIONSHIP BETWEEN RECURRENCES OF RHEUMATIC FEVER AND RORSCHACH INDICES OF ANXIETY IN CHILDREN

(L. C. Card No. Mic 59-2083)

Frances G. Koenig, Ph.D.
New York University, 1959

Chairman: Professor Howard M. Newburger

The purpose of this study has been to discover the relationship between recurrences of acute attacks of rheumatic fever and Rorschach Test indices of anxiety in children. Did repeated attacks reveal greater anxiety than one attack? Even for 47 cardiologists contacted, this subject has many unknowns, not only in the organic sense, but also in the etiology and in the emotional effect. Some hold the opinion that anxiety has bearing upon changes in personality, that a serious illness, like rheumatic fever, may have a deleterious effect upon children and that anxiety and insomnia are manifested most often.

The investigator studied 80 cases between 10 and 12 years of age in Irvington House, a convelescent home for such children. The control group of 40 cases had one acute attack of rheumatic fever past the age of 10, while the experimental group of 40 had from two through five attacks, the first under 10. Age at onset plays a role in the possibility of recurrences, since children with rheumatic fever at an earlier age are more likely to have recurrences than those past the age of 10. All were delimited as to age at onset, upper age limits, hospitalization and socio-economic levels.

The hypotheses were that children with recurrences will exhibit greater anxiety than children with one attack, and that they will be categorized as more pathological, based on the Rorschach Test indices.

A search of medical, social and educational elements

for pertinent data was made. The Rorschach Psychodiagnostics Form Interpretation Test was interpreted and the anxiety indices were assigned values. Those with five to 10 indices of anxiety were designated as indicative of anxiety neurosis; three to four indices were designated as indicative of anxiety trend; one or two indices were considered as indicative of a need for follow-up; no anxiety indices were designated as normal.

A vital adjunct has been that diagnosis is not sufficient and that evaluation can best be served by recommendations for treatment for cases with indicated need. Cases with five to 10 indices were recommended for individual therapy; one or two indices with follow-up for possible changes in the rise of anxiety features; and normal protocols have no recommendations for psychotherapy.

Rorschach indices and recommendations based upon these were tabulated. In the control group of 40 cases there were 21 normal protocols; 11 showed one to two indices with a need for follow-up; five cases fell into the three to four indices category with a need for group therapy; and three fell into the five or more indices category with a need for individual theragy. In the experimental group of 40, there were only two normal records with no indices; in the one to two indices were six with follow-up indicated; 10 cases were in the three to four indices and were recommended for group therapy; and 22 children fell into the five or more indices category and were recommended for individual therapy. All cases in the experimental group, except two, were marked to some degree in anxiety feature, thus making 32 in need of therapy; with six to be watched. Eight cases in the control group were in need of therapy and 11 to be watched. Thirty-two had normal records in the control group as against eight in the experimental.

The test results suggest that children with recurrences exceed normal children in the degree of anxiety. Anxiety in the experimental group is more marked than in the control group. The younger the age of the children during the first and ensuing attacks, the more intense the anxiety indicators and the more there are. Such children are chronically ready for emotional disturbance. Children with rheumatic fever would do well to enter a planned therapy program upon admission to a convalescent home so that they will be assisted in releasing anxieties which might arise.

The results also suggest that parents are in need of discussion groups so that they can realistically accept their child's limitations without causing anxiety to increase either in themselves or in their child. Social workers might study the influences of socio-economic factors since income, housing, family relationships and health care have an associative value in the child's physical, mental and emotional health.

Microfilm $2.00; Xerox $5.00. 99 pages.

INDIVIDUAL DIFFERENCES IN REACTION TO FAILURE: MODE OF COPING WITH ANXIETY, AND INTERFERENCE-PRONENESS

(L. C. Card No. Mic 59-3468)

Alfred Lowe, Ph.D.
Boston University Graduate School, 1959

Major Professor: Austin W. Berkeley

The general proposition was advanced that the effect of failure on ongoing performance is to an important extent determined by the individual's mode of coping with the anxiety aroused, and by his ability to resist or overcome the interference of anxiety in cognitive functioning.

Two contrasting modes of coping with anxiety were defined as (a) the goal-oriented mode which involves persistence in the pursuit of a blocked goal, and (b) the ego-oriented mode involving withdrawal from the frustrating situation and loss of interest in it. The different implications with regard to the fate of motivation in these reactions to stress led to predictions of varying changes in ongoing performance as a consequence of frustration, on the assumption that the motivation an individual brings to a task is reflected in the energy he puts into its execution. Changes in motivation were assumed to manifest themselves as changes in output.

Previous work showed that reactions to frustration, and in particular to failure, involving shifts in motivation were related to those personality factors which determined the differential emphasis on successes and failures in recall. Specifically it was demonstrated by Bloom that individuals recalling a relative predominance of failures were goal-oriented while individuals recalling a relative predominance of successes were ego-oriented in their reactions to frustration. On this basis the differential recall pattern, expressed in the ratio of the number of failures recalled to total recall, was used as the measure to differentiate subjects in terms of their modes of coping with anxiety.

The second variable dealt with in this study was proneness to the interference of anxiety in cognitive functioning. It was argued that arousal of anxiety, apart from calling forth defensive processes and thus indirectly affecting behavior, also directly impinged on ongoing performance as an irrelevant interfering stimulus. It was reasoned that this kind of distraction would primarily manifest itself in an impairment of the accuracy of performance. Operationally this was defined in terms of the number of errors made on a task as a function of the introduction of failure. This variable was measured by means of a questionnaire.

Sixty-five subjects formed the experimental sample. They were divided into "high" and "low" groups (defined by the median, and alternatively by the upper and lower quartiles of the respective distributions) on the failure recall ratio and the interference scale. Their performance on a test of speed and accuracy (the Minnesota Clerical Test) elicited preceding experimentally induced failure was compared with their performance on an alternative form of the same test following failure. The output and error scores thus obtained were subjected to separate analyses of variance.

The predictions made on the basis of the theory advanced called for (a) a larger increase of output, following failure, on the part of subjects high on the failure recall

ratio than on the part of subjects low on this measure; (b) a larger increase in the number of errors following failure on the part of subjects high on the interference scale than on the part of subjects low on this measure.

The findings bore out these predictions and were discussed in terms of their implications for the theory advanced here and in relation to related research findings. Some of the implications of this study for further research were outlined. Microfilm $2.00; Xerox $6.80. 141 pages.

EFFECT OF THE MOTHER ON GOAL SETTING BEHAVIOR OF THE ASTHMATIC CHILD

(L. C. Card No. Mic 59-3470)

Robert Peter Morris, Ph.D.
Boston University Graduate School, 1959

Major Professor: A. William Hire

This study was a partial test of the hypothesis that there is a specific kind of relationship between asthmatic children and their mothers. The central postulate was that the mothers of asthmatic children are over-controlling of these children and over-ambitious for them, and that these children are overly dependent and conforming, particularly in the area of achievement. There were two hypotheses: (1) asthmatic child-mother pairs behave more like one another with respect to goal setting than nonasthmatic child-mother pairs, and, (2) the asthmatic child's level of goal setting rises when the mother is present and participating in the goal setting.

These hypotheses were tested by means of a modified level of aspiration procedure. Twenty asthmatic children of latency age and twenty controls were administered the Rotter Aspiration Board task, one series of trials when they were each alone with the experimenter, one series when the child's mother was present and participating in the goal setting activity.

The results supported both hypotheses and justified the conclusions that (1) goal setting is an area of functioning that is handled more consistently the same way among asthmatic children and their mothers than among the general population of nonasthmatic children and their mothers, and (2) the asthmatic child is dependent upon the mother for help with a specific kind of reality testing -- the assessment of his ability to achieve -- and the mother influences this assessment consistently in an upward direction. Finally, some additional avenues of research were suggested to clarify further the nature of the asthmatic child-mother relationship. Approaches to the question of specificity of this relationship to asthma were also suggested.

Microfilm $2.00; Xerox $3.60. 65 pages.

ASSOCIATIVE CLUSTERING AND INTELLIGENCE IN MENTAL RETARDATES

(L. C. Card No. Mic 59-3859)

William Joseph Osborn, Ph.D.
The University of Connecticut, 1959

The purposes of this study were to discover whether there are critical differences in intellectual functioning between brain-injured and familial Ss when clearly defined, and to explore the similarities and differences between older retardates and young normals of the same MA.

Sixty Ss, comprising 20 organic retardates, 20 familial retardates, and 20 normals, were individually matched for Binet MA and compared with respect to their intellectual functioning on the associative clustering task, as developed by McNemar.

The results suggested that there are more important similarities than differences between organics and familials, at least as defined by the following measures: (a) central organizing tendencies, or conceptual functioning, as measured by the associative clustering method, (b) memory or recall as measured by both the clustering and Binet methods, (c) perseverative tendencies, (d) tendencies to produce intrusions in their recall, and (e) the general capacities which the Binet most validly measures (high first factor or "abstract verbal"). Both organic and familial groups also showed similar degrees of inter-individual variability, and a similar spread of success and failure over the age levels on the Binet. The only significant differences between these groups occurred in the area of visual-motor functioning, where the organics showed relative impairment, and in vocabulary functioning, where the organics showed relative strength.

On the basis of these results it was inferred that the organic-familial dichotomy, as a basic system for classifying mild retardates, is of questionable utility. It was suggested that factors other than familiality and organicity per se should be considered if discreet sub-groups of mild retardates are to be isolated.

The major difference found between the older retardates, as a group, and the young normals of the same MA was that the retardates were a more heterogeneous group, and showed much less consistent functioning, on both the Binet and clustering tasks. They scattered into higher age levels on the Binet, and attained maximum clustering earlier than the controls, but showed a characteristic premature dip in clustering efficiency. The retardate's earlier attainment of maximum clustering was explained on the basis of higher age level and, hence, greater prior reinforcement. The retardate's premature dip in clustering efficiency was described as consistent with general tendencies toward highly variable performance, and indicating some kind of interferences in cognitive processes which deserve further study.

No significant differences were found between retardates and normals with respect to gross functioning. The retardates organized concepts, recalled words, and solved various types of Binet problems as adequately as did the normals. Moreover, in the analysis of progressive changes in clustering over the recall period, the groups showed similar low levels of initial clustering, terminal declines, and reached approximately the same maximum.

The study suggested that institutionalized high-grade retardates, whether of organic or familial etiology, tend

to suffer from interferences which lower their total scores and obscure any specific patterns of assets and liabilities which may be present. Further studies of the nature of these interferences, and of the learning processes in retardates were suggested as particularly important.

Microfilm $2.00; Xerox $5.00. 98 pages.

A COMPARISON OF MEMORY AND LEARNING ABILITY WITH SOCIAL COMPETENCE AND SOCIAL PARTICIPATION IN AGED SENILE DEMENTS IN A MENTAL INSTITUTION

(L. C. Card No. Mic 59-2087)

Bertha Santos, Ph.D.
New York University, 1959

The purpose of this investigation was to determine the degree of social competence and participation in a randomly selected sample of 70 institutionalized senile dements, equated for sex, and to determine the relationship between their memory and learning ability with their social competence and participation. The group was selected from patients at Creedmoor Institute for Psychobiological Studies, Queens Village, New York.

It was necessary to ascertain the relation between: a) Memory and Learning ability in seniles, (as determined by the Wechsler Memory Scale, the modification of the Block Design Test as used in the Wechsler Adult Intelligence Scale, and the Human Figure Drawings as scored by the Goodenough Scoring System), and, b) Social Competence of those seniles (as determined by the Vineland Social Maturity Scale and the Investigator's Geriatric Social Participation Questionnaire). It was also necessary to ascertain whether there was a statistical sex difference between memory and learning ability and social competence in these aged seniles.

Also investigated were: 1) the statistical difference between the Wechsler Memory Raw Score and the Wechsler Memory Quotient (a score corrected for age) in evaluating the memory level of aged persons, and, 2) the statistical difference between the time-limit scoring of the Wechsler Block Design Test, and a no-time-limit scoring method for the same test as used by the Investigator.

Each patient was tested individually with the Wechsler Memory Scale, the Block Design Test, and the Human Figure Drawings.

After the patient completed his examination, the nurse or attendant most familiar with him was interviewed by the Investigator, and the responses were recorded on the Vineland Social Maturity Scale and on the Investigator's Geriatric Social Participation Questionnaire. The reliability of this Questionnaire was determined in a pilot study using 25 aged patients. After retesting these patients to determine the reliability between test-retest, it was shown that the Pearson Product-Moment Correlation Coefficient between them was .93, which is a clearly significant correlation below the .05 level of confidence.

The results showed that of the 64 possible Pearson Product-Moment Correlation Coefficients, 62 correlated significantly at the .05 level of confidence. The two non-correlations occurred in the population of 35 women, and in both cases one of the variables depended on the judgment of the female nurse in evaluating her charges. This suggests that: 1) either the female nurse is not as perceptive and knowledgeable of her wards as is the male attendant of his wards, or, 2) the aged female seniles are more covert, and better able to obfuscate their behavior, so that the nurse is less able to know them. Another possibility for the two non-correlations was the fact that the Figure Drawing age value (in months) in women had a 53% wider range than for the men, indicating greater age instability and variability.

It was concluded that: 1) There was a statistically significant relationship between memory and learning ability, and social competence and participation. 2) There were no statistically significant sex differences between memory and learning ability and social competence. 3) There were no statistically significant differences between the Wechsler Memory Raw Score and the Wechsler Memory Quotient in evaluating the memory level of these seniles, or between the Wechsler scoring of the Blocks and the Investigator's No-Time-Limit scoring method in evaluating the learning ability of these seniles. This latter comparison suggests that a time limit factor may introduce an unnecessary strain, thus lowering the aged person's performance on Blocks. 4) It was also found that no significant differences for age existed in the group of 70 patients, thereby indicating age homogeneity for the group.

Microfilm $2.00; Xerox $5.00. 97 pages.

DEPENDENCY FACTORS IN RELATION TO RECALL OF DEPENDENCY MATERIAL

(L. C. Card No. Mic 59-3651)

Edleff Helmut Schwaab, Ph.D.
Boston University Graduate School, 1959

Major Professor: A. William Hire

The study is an investigation of the relationship between the motivational state of dependency and cognitive behavior. Specifically it was directed toward exploring differences between dependency conflicted and nonconflicted subjects in regard to recall efficiency of dependency-charged and dependency-neutral verbal material. A developmental and dynamic point of view was chosen in defining dependency as a basic need universally found in human beings and having universally an important role in the maturation and socialization of the individual. On the basis of theoretical considerations concerning the concept of dependency and on the basis of assumptions derived from related experimental studies it was asserted that response variation in the performance of a cognitive task can be systematically related to the conflict status of a specific need. Need-related stimulus material interacting with a nonconflicted motivational state has a facilitating effect, while the same stimulus material interacting with a conflicted motivational state will show inhibiting effects.

Dependency conflict status of experimental subjects was determined by means of a multiple-choice story-completion technique. Empirically derived scoring patterns were used to define "nonconflicted" and "conflicted". Subjects in the latter group fell into either one of three subgroups: Dependency-Accepters, Dependency-Deniers, and Vacillators.

The following hypotheses were formulated: (1) Recall efficiency of conflicted subjects will be detrimentally affected in the recall of stimulus material with dependency-charged content. (2) Recall efficiency of nonconflicted subjects will not be affected in the recall of stimulus material with dependency-charged content. (3) In the recall of neutral stimulus material the recall efficiency of conflicted subjects will not differ from that of nonconflicted subjects.

Seventy-two subjects were included in the study; forty-three were nonconflicted and twenty-nine conflicted. They were freshmen at the Boston University College of Industrial Technology, all males with a mean age of twenty. There were no significant differences in age or intelligence between the two groups.

Subjects were seen in one session. First they were given the story-completion test. Then a story neutral with respect to dependency content was read, and a measure of immediate recall was taken. The same procedure was used for a dependency-laden story. The two stimulus stories contained sixty-five words each, grouped in twelve thought units. Recall data were scored according to scoring criteria which considered accuracy of recall.

An analysis of variance technique was employed in testing the statistical null hypothesis that the difference between the mean recall scores of the two major groups on the dependency story will be equal to the corresponding difference on the neutral story. An additional analysis was made of the differences of means among the Dependency-Accepters, Dependency-Deniers, and Vacillators.

The findings allowed the following conclusions to be drawn: there is evidence that inhibition in cognitive efficiency occurs upon interaction of dependency-conflicted material with a corresponding conflictual motivational state, whereas no such inhibition occurs in the interaction of neutral material with either dependency-conflicted or nonconflicted motivational states. The findings offered further evidence for believing that a certain general relationship exists between motivation and cognitive processes. It was suggested, however, that there is a need for further isolation of specific need states and other relevant variables before systematic assumptions can be made and before explanatory concepts can be developed which embrace parameters of the variety of motivational behavior. Other implications for further research are discussed, particularly the need for more refined quantifying techniques, more systematic treatment of the concept of dependency and study of this concept in relation to the variables of sex and development. The relevance of the investigation of dependency for the larger field of psychopathology was pointed out. Microfilm $2.35; Xerox $8.20. 179 pages.

THE EFFECT OF SOCIAL EVALUATION AND SUCCESS AND FAILURE ON THE ATTRACTIVENESS OF ACTIVITIES

(L. C. Card No. Mic 59-4095)

Lester Jerome Schwartz, Ph.D.
Columbia University, 1959

The development of an interest is contingent upon the experiences and the consequences of the experiences that individuals have with specific activities. It was the purpose of this study to investigate hypotheses concerning the effect of two variables which have been commonly posited as two crucial factors in determining the attractiveness of activities for individuals. These variables are social evaluation and success or failure experience associated with the activity. Based on a rational of reinforcement theory which includes the concept of expectancy, it was hypothesized that among adolescent boys, success experience with an activity in the presence of either positive or negative social evaluation results in greater activity attractiveness than does failure experience, and that the introduction of positive social evaluation in the presence of either success or failure results in greater activity attractiveness than does the introduction of negative social evaluation.

The subjects of the study were 120 boys of working class families who were between 13 and 15 years of age. Half of the subjects succeeded in an activity while half failed. The object of the activity was for a subject to see how far up a scale he could pull a small ball which was balanced on a pyramid shaped platform. Before using the activity, half of the subjects were told by their peer leader that he thought the activity was a desirable one. The other half were told by their peer leader that he thought the activity was an undesirable one.

A seven-point rating scale was constructed to measure the degree of attractiveness of the activity. Four groups of 30 subjects each emerged from the study: (I) positive social valuation and success, (II) positive social evaluation and failure, (III) negative social evaluation and success, and (IV) negative social evaluation and failure.

The results of this study supported the hypotheses advanced. Additional statistical analysis of the data suggested that extrinsic social reinforcement may have been more influential in influencing the activity attractiveness than success or failure. The findings were interpreted as supporting a theory of activity attractiveness according to the principles of reinforcement theory. The implications of such a theoretical framework for interest theory were then discussed.

Conclusions

1. The attractiveness of an activity to urban boys of the working class is influenced by the social evaluation applied to the activity by the boys' peer leaders.
2. The attractiveness of an activity is also influenced by the boys' success or failure experiences with the activity.

Microfilm $2.00; Xerox $3.00. 47 pages.

THE LATENCY OF THE SPIRAL EFFECT AND AFTEREFFECT AS A FUNCTION OF ILLUMINATION AND SPEED OF ROTATION

(L. C. Card No. Mic 59-3870)

Alexander Stern, Ph.D.
The University of Connecticut, 1959

Interest in the Spiral Effect and Spiral Aftereffect arose from recent claims that the inability to perceive the Spiral Aftereffect significantly separates patients with organic

brain damage from those having no such involvement, as well as differentiates among certain neuropsychiatric nosological groups. Since there has been no systematic study of the relevant independent variables determining these effects, this study investigated the effect of intensity of illumination and of speed of rotation of the spiral stimulus upon the latency of both phenomena. Four intensities of illumination and four speeds of rotation of the presented spiral stimulus were chosen as covering a major portion of the range in which the effects could be experienced.

Twenty-one healthy subjects of both sexes participated in the experiment. The stimulus for the evocation of the phenomena was a disc with a spiral pattern on it, which was perceived by the subjects monocularly, in peripheral vision, consistently falling on the same retinal area. Measurements of the latency of the Spiral Effect and the Spiral Aftereffect were obtained from each subject for each of the 16 experimental conditions.

The statistical treatment of the results has shown that the overall effect of decreasing intensity of illumination, or of increasing speed of rotation of the spiral stimulus was to significantly shorten the latency of both the Spiral Effect and the Spiral Aftereffect. In each of the 16 conditions the mean value for the Spiral Effect was larger than the corresponding value for the Spiral Aftereffect. The treatment of the data indicated that the variability of the subjects was a significant codeterminer of the latency of both phenomena. Among the interactions only that of speed of rotation x subjects was significant for both the Spiral Effect and the Aftereffect. The interaction of levels of illumination x subjects was significant for the Spiral Effect, but insignificant for the Spiral Aftereffect. For both phenomena the interaction of speed x illumination was insignificant. No significant difference was found between the performances of male and female subjects.

The correlations between the scores of the various conditions, for Spiral Effect were, for the most part, larger than those for the Spiral Aftereffect. The smallest correlations were obtained for the values between the Spiral Effect and the Spiral Aftereffect. The overall correlation between the two phenomena was high.

The findings have thus shown that, within the limits tested, the latency of the two spiral phenomena was inversely related to the velocity of the rotating stimulus and directly related to the intensity of illumination. The apparent differential effect of the stimulus strength upon the spiral phenomena created a paradoxical situation. It was noted that the increase in the stimulus strength due to increased speed of rotation caused an increase of the strength of the phenomena, while the increase of the stimulus strength due to increased intensity of illumination caused a decrease of the spiral phenomena. An explanation of this seemingly paradoxical finding was offered in terms of contrast effects.

Special problems and possibilities for the clinical application of these findings were considered and discussed. It was suggested that in the application of the Spiral Aftereffect test the conditions pertaining to intensity of illumination and speed of rotation of the stimulus be standardized so as to insure uniform use of the test. The possibility of establishing norms for gauging the extent of brain damage in terms of response to the phenomenon under varied conditions of illumination and speed of rotation was also discussed.

The results of the present study were related to findings of previous investigators. The spiral phenomena were also discussed in the framework of Kohler's electrochemical wave theory and Kohler-Wallach's satiation theory.

Finally, stimulus qualities common to the Archimedes Spiral and the flicker light were noted. The existing similarity in the Spiral Effect and the critical flicker fusion phenomenon was pointed out. These common characteristics suggested that there may be a common mechanism underlying the Spiral Effect and the critical flicker fusion phenomenon. Microfilm $2.00; Xerox $6.40. 135 pages.

THE EFFECTS OF TEACHER-PRESENTED CUES UPON THE LEARNING OF DELINQUENTS AND NONDELINQUENTS

(L. C. Card No. Mic 59-3655)

Nicholas Verven, Ph.D.
Boston University Graduate School, 1959

Major Professor: Assistant Professor Murray Cohen

Theory

The purpose of this study is to investigate whether attitudes conceived to be characteristic of delinquents affect their performance in a learning situation. Two diagnostic groups are identified: character-disorder delinquents, who are conceived to have suffered an early defect in personality formation; and neurotic delinquents, whose personality formation resembles nondelinquents, and whose delinquency is felt to be an expression of neurosis in adolescence. The character-disorder delinquent has an attitude of distrust that is generalized toward all adults. The neurotic delinquent and the nondelinquent tend to perceive adults as trustworthy.

A typical learning situation in the classroom may be conceived to have two classes of cues: (1) information presented by a teacher, and (2) task-inherent cues, or information other than teacher-presented cues in the stimulus field of the task. Task inherent cues are always relevant cues, i.e., compatible with learning. Teacher-presented cues may be relevant or irrelevant, i.e., may be correct or incorrect information. It is hypothesized that because of his attitude of mistrust toward adults, the character-disorder delinquent does not incorporate teacher-presented cues. Nondelinquents and neurotic delinquents do incorporate teacher-presented cues in learning.

Predictions

In a learning situation in which teacher-presented cues are relevant cues, nondelinquents and neurotic delinquents will learn more effectively than character-disorder delinquents. Conversely, in a learning situation in which teacher-presented cues are irrelevant cues, character-disorder delinquents will learn more effectively than nondelinquents and neurotic delinquents.

Methods and Procedure

The learning tasks are two maze problems. Each maze has 30 choice points with two alternatives, one of which the subject selects by punching holes in a response sheet. Repeated trials are given until a criterion of three successive perfect trials is reached. Each maze may be learned

with no information given beyond the instructions, however, some ostensibly helpful information is added. This is the suggestion that the subject search for a pattern of correct choices. This suggestion is defined as the teacher-presented cues. Two scores are achieved: the sum of trials to criterion for each task. In Task I the teacher-presented cues are relevant cues; in Task II they are irrelevant.

Three groups of twenty subjects each were operationally defined as follows: character-disorder group, delinquency first appeared before the age of 11; neurotic group, no history of delinquency before the twelfth birthday; non-delinquent group, no history of delinquency. The groups were matched for age, I.Q. score and father's occupation.

Results and Conclusions

For the character-disorder group the mean trials to criterion on Test I was 27.25; Test II, 18.40. For the neurotic group the mean trials to criterion on Test I was 19.00; Test II, 21.85. For the nondelinquent group the mean trials to criterion on Test I was 18.35; Test II, 22.50. On the basis of statistical tests applied to the data, the data confirm the predictions.

It is felt that the primary factor which impedes the achievement in school of the character-disorder delinquent is his antagonism toward authority, of which the school and its teachers are important symbols. The experiment was designed to investigate whether this tendency could be shown to impede his learning in comparison to neurotic delinquents and nondelinquents in a situation analogous to that of the school, and to investigate whether his learning would be better than that of the neurotic and nondelinquent when rejection of teacher-presented cues would be expected to facilitate learning. The data supported the theoretical notions which led to the predictions.

Microfilm $2.00; Xerox $5.60. 113 pages.

THE EFFECTS OF REPEATED SUCCESS AND FAILURE EVALUATIONS UPON THE PERFORMANCES OF FEMALE JUVENILE DELINQUENTS AND NON-DELINQUENTS

(L. C. Card No. Mic 59-3873)

Alan Willoughby, Ph.D.
The University of Connecticut, 1959

a. The problem.

The specific interest of this study was in the female juvenile delinquent's reactions to the commonly used social incentives of success and failure evaluations of performance.

Predictions were based upon a tested theoretical model which postulates that High Anxious (HA) or High Interference (HI) subjects are likely to respond to anxiety-evoking situations with responses which are irrelevant to the successful completion of the task. Low Anxious (LA) or Low Interference (LI) subjects theoretically have a system of response tendencies which renders likely the evocation of task-relevant responses. Certain clinical observations and authoritative opinions permitted the assertion that delinquents were relatively HA subjects, whereas their non-delinquent controls could be designated LA. Within the system, motivation energizes one or both of two mutually exclusive classes of response, which are than called motivated task-relevant (MTR) and motivated task-irrelevant (MTI) responses. Predictions were based on the relative strengths of these two classes of response. In the absence of prior evidence, delinquent MTR's were said to be equal in strength to delinquent MTI's; non-delinquent MTR's were said to be stronger than non-delinquent MTI's.

b. Procedure.

The subjects were thirty institutionalized delinquent girls and an equal number of non-delinquent controls. Subjects were 15-16 years old, residents in high delinquency areas, of average intelligence (within 1 S.D. of the mean on a standard IQ test), and were white, native-born, and non-Jewish.

Nine trials of an arithmetic summation task were used, presented alternately with a tweezer task which did not enter into the findings. Measures were time to completion of the task and number of errors committed in the performance of the task. Three incentive conditions were employed: A neutral, task-oriented condition; an ego-oriented, success condition; and an ego-oriented failure condition. In the latter groups, subjects received false evaluations of performance. There were ten subjects in each of six incentive groups. Instructions stressed speed.

c. Results.

The results essentially supported the hypotheses. Although motivated, the delinquents did not work with progressively greater speed under N, S or F conditions, in that order; significant non-delinquent differences were obtained where the greatest difference was theoretically expected. Delinquents under ego-involved conditions did not increase speed from pre-test to post-test. Non-delinquents did so. Non-delinquents worked faster than delinquents under ego-involved conditions. Delinquents did not commit progressively more errors under N, S or F conditions; significant non-delinquent differences were obtained where the greatest difference was expected. (Under the conditions of the investigation, errors were the logical outcome of increased task-relevant responses.)

d. Conclusions.

The results suggested that the theoretical statements regarding relative strengths of MTR's and MTI's would be sharper if revised as follows: Under the conditions of this investigation, both delinquent and non-delinquent MTR's are stronger than the respective MTI's. The difference between these two classes of response is of lesser magnitude for delinquents than for non-delinquents.

The results of this study suggest that female juvenile delinquents, even when motivated, are unable to respond according to the demands of the situation because of high levels of anxiety and their peculiar pattern of reaction to it. It would seem reasonable to conclude that efforts to alter delinquents' anti-social behavior might well be preceded by attempts to reduce the level of anxiety. Emphasis was placed on the importance of reduction of anxiety, rather than on specific ways to do it.

Suggestions for further research centered on an exploration of the variables which might be expected to change the relative strengths of MTR's and MTI's.

Microfilm $2.00; Xerox $4.80. 91 pages.

PSYCHOLOGY, EXPERIMENTAL

SOME EFFECTS OF COMBINING CERTAIN ACOUSTIC CUES FOR THE PERCEPTION OF THE STOP CONSONANTS

(L. C. Card No. Mic 59-3829)

David Angell, Ph.D.
The University of Connecticut, 1959

Experiments on the perception of the sounds of speech have indicated that the acoustic cues comprising the speech signal tend to maintain their separate identities when presented in combination. The cues apparently enable the listener to make several essentially independent decisions leading to identification of the sound.

In the present experiment, selected acoustic cues for the voiced stop consonants b, d, g were combined in all possible ways and presented in conjunction with formants for the vowels e, a, and o for the judgment of naive subjects. The following cues were used: (1) a burst-like concentration of acoustic energy preceding the vowel formants; (2) a transition of the second formant; (3) a transition of the third formant. The cue values used here were those which had been found in previous experiments to be most effective in producing perception of b, d, and g with the vowels e, a, and o.

A special purpose playback machine was used to convert the handpainted spectrographic patterns into sound. The individual auditory stimuli were recorded on magnetic tape and spliced into random orders for presentation to the subjects. Subjects judged each sound as b, d, or g. Two-hundred seventy-four subjects participated, each subject making two sets of judgments.

Results support the concept of independence of cues. It is found that results of cue combinations are predictable from a knowledge of the response properties of individual cues. A model is described for generating predictions of responses to cue combinations when response distributions to patterns containing single cues are known.

The model involves combining response probabilities in a simple linear fashion. A test of the hypothesis of cue independence is provided by comparing values predicted as the result of combining any two cues, with values obtained from stimulus patterns in which the two cues are paired. Correlations between predicted and obtained response distributions are significant, and it is concluded that the acoustic cues for the perception of the stop consonants function in an independent, rather than an interacting, fashion. Microfilm $2.00; Xerox $3.60. 61 pages.

THE EFFECT OF EFFORT ON THE INTRINSIC ATTRACTIVENESS OF A STIMULUS

(L. C. Card No. Mic 59-3680)

Elliot Aronson, Ph.D.
Stanford University, 1959

A laboratory experiment was conducted to test the effect of effort on the attractiveness of stimuli. Subjects were required to fish for flashlights in order to obtain money which was inside some of them. The subjects were in one of two conditions which differed in the amount of effort involved in performing the task. In the Difficult condition, the task required a great deal of effort. It involved dangling a hook on the end of a string and attempting to insert it in a small metal eye which protruded from each flashlight. In the Easy condition, the subjects merely had to attract the flashlight with a horseshoe magnet; this required very little effort. Some of the flashlights were red and some were green. Those of one color contained money and those of the other color were empty. The flashlights were hidden from view so that the subjects were unable to see the colors until after they had pulled them out. The subjects rated the attractiveness of the colors both before and after the experiment.

The hypothesis was that, as effort increases, the tendency to attach value to stimuli associated with the unrewarded response will also increase. Specifically, in the Difficult condition, it was predicted that the unrewarded color would become relatively more attractive than in the Easy condition. The hypothesis was derived from Festinger's theory of cognitive dissonance in the following way. If an individual is engaged in a repetitive and effortful activity in order to attain a reward, each time he is unrewarded the cognition that he exerted a great deal of effort to receive a reward is dissonant with the cognition that he did not receive a reward. One way in which he can reduce this dissonance is by finding something in the environment during the unrewarded trials to which he can attach value. In this way, he could justify the expenditure of effort. Since the environment was identical in the rewarded and unrewarded trials except for the color of the flashlights, a convenient way to reduce dissonance would be by finding the unrewarded color to be more attractive than he had previously thought. If little or no effort is involved, however, there would be nothing to justify; hence, one would not expect the subjects in the Easy condition to be as prone to find something attractive about the environment.

The results verified the hypothesis. In the Easy condition the subjects showed a marked tendency to find the rewarded color more attractive after the experiment than before the experiment. In the Difficult condition, however, the attractiveness of the colors did not shift in the direction of the rewarded color.

The results were explained in terms of the theory of cognitive dissonance and secondary reinforcement theory. Secondary reinforcement theory leads to the prediction that stimuli associated with reward will become more valuable. Thus, according to our interpretation, in the Easy condition, the rewarded color was seen as being relatively more attractive than the unrewarded color. This also occurred in the Difficult condition. But here, dissonance was also involved. The effect of dissonance operated to make the unrewarded color more attractive. These two opposing forces tended to counterbalance each other producing no appreciable net change in the Difficult condition. Microfilm $2.00; Xerox $3.00. 47 pages.

CONFIDENCE RATINGS, SECOND-CHOICE RESPONSES, AND CONFUSION MATRICES IN INTELLIGIBILITY TESTS

(L. C. Card No. Mic 59-3993)

Frank Russell Clarke, Ph.D.
Indiana University, 1959

Typically, the study of speech transmission over noisy communication circuits has utilized tests in which the observer was limited to a single identification response. The purpose of the studies reported in this paper was to investigate the behavior of observers when they were given the opportunity to make a second response on each message presentation in an attempt to convey additional information about the transmitted message.

Two types of secondary responses were studied: 1) after making an initial identification response the listeners made a second-choice identification response, and 2) after making an initial identification response the listeners made a rating response in an attempt to estimate the probability that their identification response was correct.

It was found that when the listeners were allowed a second-choice identification response, very little information was contained in these responses which was not already contained in the listeners' first-identification response. Furthermore, there is no practical way in which the observers can utilize this additional information. All models used in an attempt to predict the stimulus by second-choice matrix from the stimulus by first-choice matrix were inadequate.

When the second response was a confidence rating, a significant amount of information was added to that which was carried by the identification response. Furthermore, in many practical situations, it would be possible for the observer to easily use this additional information in order to markedly increase his probability of a correct response.

The rating which followed each identification response was assigned by the observers in an attempt to estimate the probability that their identification response was, in fact, correct. For message sets of four items and for sets of sixteen items, it was found that the observers were quite capable of making such estimates over a wide range of speech-to-noise ratios. Their estimates did appear to be affected to some extent by the size of the message set and by the speech-to-noise ratio, but this interaction was slight.

The observers' rating responses were used to generate ROC-curves. These curves were adequately fit by straight lines when the data were plotted on normal-normal probability paper. Regardless of the size of the message set all curves, for all speech-to-noise ratios, were fit by a single slope. However, the point at which these curves intersected the abscissa was a function of both variables.

Data from one set of observers in the rating experiments were used in an attempt to predict the performance of a different group of observers whose task was to monitor subsets of messages. While predictions were fairly good, discrepancies were noted. An internal check in the monitoring experiment strongly suggests that these discrepancies arose because of differences between the two groups of observers.

Microfilm $2.00; Xerox $5.20. 103 pages.

HUMAN HEART RATE DURING EXPERIMENTALLY INDUCED ANXIETY

(L. C. Card No. Mic 59-3837)

George Edward Deane, Ph.D.
The University of Connecticut, 1959

One proposed paradigm for the experimental establishment of anxiety is the pairing of an initially neutral stimulus with an aversive stimulus. Various autonomic responses have been employed as behavioral manifestations of anxiety, and electric shock has been employed commonly as the aversive stimulus. Although change in heart rate has been employed as the autonomic manifestation of anxiety in a number of studies, there has been far from complete agreement as to the direction of the change during anxiety. Some studies have reported cardiac acceleration, while others have reported deceleration in the interval between warning signal and shock. This study was designed to discover some of the controlling conditions of these two cardiac effects.

Base level measurements of cardiac activity were made while Ss were watching the numbers 1 through 12 appear in the window of a memory drum. Then, each of the 36 male Ss was assigned at random to 1 of the 4 following conditions: (a) one-shock-at-number-10 condition--the Ss were told to expect a shock on number 10, and did receive it on the first trial; (b) no-shock-at-number-10 condition--the Ss were told to expect a shock on number 10, but never received it; (c) one-shock-at-unstated-number condition--the Ss were told to expect a shock on some number and actually received one on number 10 during the first trial; (d) no-shock-at-unstated-number condition--the Ss were told to expect a shock on some number, but never received one.

In all groups there was an acceleration in heart rate over the base level on the first shock anticipation trial. In the 2 groups that actually received the shock on the first trial the acceleration had disappeared by the second trial and it remained absent during the following trials. In the 2 groups that never received the shock, the acceleration remained during the following trials.

Both groups that expected shock on number 10 also showed a deceleration in rate immediately prior to and during presentation of number 10. The no-shock-at-unstated number group which was not told to expect shock on number 10 did not exhibit this deceleration.

Apparently, the acceleration which occurs after warnings of approaching shock is a relatively enduring effect which disappears completely only after S experiences the subjectively mild shock. The deceleration, on the other hand, appears and remains regardless of whether or not any shock is received.

Neither a simple stimulus substitution view of conditioning nor the Hullian reinforcement theory appear to be able to account for the learning of both cardiac responses. It may be speculated that these two cardiac effects provide a possible empirical distinction between anxiety and fear. A state of anxiety with its correlated response of cardiac acceleration is assumed to exist when S is told that sometime in the future he will receive an aversive stimulus of unknown strength. If, in addition, S knows exactly when to expect the aversive stimulus a state of fear with its correlated response of cardiac deceleration will occur immediately prior to and during the time the aversive

stimulus is expected. Experimental tests of this hypothesis should be attempted using aversive stimuli other than shock. Microfilm $2.00; Xerox $3.00. 49 pages.

EFFECTS OF FORCED REWARDED AND NONREWARDED TRIALS IN T MAZE LEARNING

(L. C. Card No. Mic 59-4003)

Raymond Winter Frankmann, Jr., Ph.D.
Indiana University, 1959

The conditioning effects of nonreinforced trials were investigated using water-deprived rats in a T maze. Running to one of the arms was designated response A_1; running to the opposite arm was response A_2. Two independent variables were employed: (a) the number of reinforcements (0, 28, or 68) in an initial series of forced choice trials, equally distributed between the two responses; (b) the number of nonreinforced trials (1, 4, or 12) in a subsequent series of forced A_2 responses. A 3x3 factorial design with 20 subjects per cell was used. After the training series, each subject received 14 nonreinforced free choice trials. A 24 hour intertrial interval was used for all nonreinforced trials and the last four reinforced trials.

The proportion of A_1 responses on free choice trials was not affected by the number of reinforced trials and was an increasing function of the number of forced nonreinforced A_2's. For 12 forced nonreinforced A_2's the proportion of A_1's on the initial free choice trial was significantly greater than .50 for all numbers of reinforced trials. During the free choice series the proportion of A_1's decreased to about .50 for all groups.

The number of reinforced trials produced large differences in start and goal (running) speeds throughout the experiment. Typical extinction effects occurred for goal speed during nonreinforced trials while start speed was relatively insensitive to the number of reinforcements. For speed differences between the first and second halves of the free choice trials, the number of reinforcements was significant for start and goal speed and the interaction of this variable with the number of nonreinforced trials was significant for goal speed only. The subjects that received no reinforced trials showed a significant increase in start speed during the free choice trials.

The experimental findings were discussed with respect to statiatical learning theory in terms of a specialization of the Estes and Suppes linear model and a four-state Markov model. Both models predicted major findings of the present study and related experiments, particularly with respect to differences between correction and noncorrection procedures.

Reinforcing events were analyzed into two components: empirical goal events and theoretical conditioning events. Following a distinction due to Estes, goal events involving reinforcement were assumed to be determinate in the sense that they produce conditioning events that increase the probability of the reinforced response. Nonreinforcing goal events were assumed to be indeterminate in that they may result in increasing, decreasing, or leaving unchanged the probability of the response that leads to nonreinforcement. To study various assumptions about nonreinforcement, probability vectors were defined to specify the relation between goal and conditioning events. It was shown that the data rejected the "neutral" assumption that nonreinforced trials always leave response probabilities unchanged. The conditioning consequences of nonreinforced trials depend on reinforcement history and may be analysable in terms of such factors as secondary reinforcement and terminal responses, e.g., attempted corrections, that occur during detention in the unbaited goal box.

Microfilm $2.00; Xerox $5.00. 96 pages.

DIFFERENTIAL DISCRIMINATION OF FREQUENCY OF CUTANEOUS MECHANICAL VIBRATION

(L. C. Card No. Mic 59-4222)

Genevieve Dugan Goff, Ph.D.
University of Virginia, 1959

To measure human ability to discriminate differences in frequency of a cutaneous mechanical vibratory stimulus, it is imperative that cues from concomitant changes in subjective intensity of the stimulus be eliminated. Previous attempts to control intensity are criticized. In the present study intensity was controlled by having the subjects make equal-intensity judgments of all the frequencies used.

The apparatus, patterned after that of Sherrick, incorporated two major improvements over previous studies: a switching amplifier eliminated transients, and the amplitude of vibration was directly observed while the contactor stimulated the skin of each of the four subjects, thus assuring that damping effects were included in the calibrations.

Absolute thresholds were measured at the finger tips. Curves of equal subjective intensity were obtained by having subjects match each variable frequency with a standard of 100 c.p.s. at each of two intensity levels, 20 d.b. and 35 d.b. above the absolute threshold of the 100 c.p.s. standard. Graphs were presented for the individual subjects showing the curves of equal subjective intensity and the absolute thresholds.

Delta f was measured at 25, 50, 100, and 150 c.p.s., all amplitudes being within the equal intensity curves of the particular subject. Graphs of the difference limen and the relative difference limen as a function of frequency of stimulation are presented. Both delta f and the Weber fraction increase markedly as frequency increases. Also, both are lower at the higher intensity level.

An analysis of the ratios of the energy in the standard stimulus to the energies of the comparison stimuli revealed that subjects could not have been using energy as a discriminative cue, but must have been discriminating frequency differences.

A graphical comparison of delta f for audition with delta f for cutaneous vibration indicates one reason for the failure of Gault's system for vibratory communication. Suggestions are made for utilizing frequency as a dimension in the vibro-tactile communication system described by Geldard. Microfilm $2.00; Xerox $4.80. 94 pages.

RELATIONS OF RESPONSE VARIABILITY IN CONDITIONING AND EXTINCTION

(L. C. Card No. Mic 59-4067)

Irving A. Goldberg, Ph.D.
Columbia University, 1959

The experiment was designed to explore the variability of bar pressing in acquisition and extinction. It was proposed that consideration of the bar pressing response in terms of some of its intensive dimensions (force, duration, topography, etc.) would demonstrate some acquisition-extinction relationships and answer some questions about differential resistance to extinction. It was suggested that it might be necessary for some purposes to test the generic class of response in terms of the sub-classes of which it is composed. The consideration of response sub-classes led to the expectation that the number of extinction responses in each response sub-class should be functionally related to the acquisition strength of that sub-class.

The expected acquisition-extinction relation led to the further proposition of a relation between response variability and resistance to extinction. It was suggested that differential resistance to extinction is resultant from the reinforcement and subsequent extinction of different numbers of response sub-classes in partial versus regular reinforcement schedules.

Thirteen male albino rats of Wistar strain were randomly divided into three groups (I, II, and III) of 4, 5, and 4 rats respectively. All animals were maintained on 21 hours of food deprivation throughout the experiment. The rats in Groups I and II received food reinforcement for bar pressures equal to or exceeding three grams of force; the rats in Group III were reinforced for bar pressures equal to or exceeding 15 grams of force.

Bar pressing forces were recorded for all animals during one day of operant level determination, six successive days of conditioning with 35 regular reinforcements per day, and one subsequent day of extinction. Following that extinction day, bar pressures of Group I rats were recorded on six days of alternate reconditioning (with 35 regular reinforcements) and extinction; following that first extinction day, bar pressures of the rats in Groups II and III were recorded on one day of one-minute fixed interval reinforcement and a subsequent second extinction day.

The variability of bar pressing force was measured in terms of the mean deviation from the median force of each daily acquisition or extinction force distribution; the same variability measure was made for the total responses emitted in acquisition and extinction, each condition treated separately. T-tests, rank-order correlations, and concordances were made of the variability data.

The following conclusions were reached:

1. A functional relation exists between the variability of response forces in acquisition and extinction of the bar pressing response.
2. Regular reinforcement decreases the variability of response force and extinction increases it.
3. Reconditioning with regular reinforcement serves to decrease response force variability beyond the level reached during initial regularly reinforced conditioning of the bar pressing response.
4. Greater variability of response force is produced by a one-minute fixed interval schedule of reinforcement than by a regular reinforcement schedule.

Microfilm $2.00; Xerox $6.00. 125 pages.

RUNWAY PERFORMANCE AND RATE OF DRINKING AS FUNCTIONS OF SUCROSE CONCENTRATION AND AMOUNT OF CONSUMATORY ACTIVITY

(L. C. Card No. Mic 59-3795)

Kenneth P. Goodrich, Ph.D.
State University of Iowa, 1959

Chairman: Professor Kenneth W. Spence

An experiment was conducted to study the effects of sucrose incentive and number of consumatory responses (laps) permitted per trial upon locomotor and consumatory behavior in a runway apparatus. Four levels of concentration (3, 12, 24, and 48%) and three levels of number of laps (5, 40, and 145) were employed in a factorial design with 12 groups of female albino rats. Sixty acquisition trials were run.

The results for asymptotic starting and running speeds showed significant effects of both concentration and number of laps, with no significant interaction of the two variables. Asymptotic speed appeared to be an increasing S-shaped function of concentration and an increasing negatively-accelerated function of number of laps. For all consumatory measures employed, concentration of sucrose had no effect upon consumatory behavior. Greater numbers of laps resulted, for most measures, in slower drinking, although for one measure an inversion in this relationship occurred. Finally, an average within-groups correlation of $\underline{r}$ = .40 was found between asymptotic running speed and lapping rate.

The results were discussed in relation to the incentive motivation hypotheses concerning the action of incentives in instrumental reward conditioning presented in Spence's Behavior Theory and Conditioning.

Microfilm $2.00; Xerox $3.00. 55 pages.

THE FLICKER ELECTRORETINOGRAM IN THE HUMAN EYE

(L. C. Card No. Mic 59-4341)

Allen Manuel Granda, Ph.D.
Brown University, 1959

The electrical flicker responses of the eye to stimulation at various wavelengths and intensities were recorded by means of a frequency analyzer. This instrument employs a tuned circuit to "lock in" on the stimulating frequency of the light flashes. Its tuning characteristics allow it to reject frequencies other than the one to which it is tuned, thus improving the signal-to-noise ratio.

The results obtained were plotted against stimulus intensity and criterion responses were used to plot sensitivity points as a basis for comparison with the standard I.C.I. photopic sensitivity curve.

The results point to the electrical responses of the eye as being more sensitive with respect to a green standard than their counterpart in psychophysical data. Various discrepancies and their possible sources were discussed.

The use of the frequency analyzer in further electroretinographic research is evaluated, particularly with problems that depend on some frequency characteristic of

the response, and where the "output energy" of the eye is of interest in the investigation.

Microfilm $2.00; Xerox $5.80. 119 pages.

CUTANEOUS DISCRIMINATION OF ELECTRICAL INTENSITY

(L. C. Card No. Mic 59-4226)

Glenn Russell Hawkes, Ph.D.
University of Virginia, 1959

The first experiments reported involved the measurement of delta I/I for alternating current stimulation of the finger tip, at stimulation frequencies of 100, 500, and 1500 c.p.s., and standard intensity levels of 120% and 200% of the current necessary to reach the RL. Two methods of stimulus presentation were used, the "beat" method, and the method of successive stimuli.

The delta I/I values found differed negligibly for the two methods used, a finding in contrast to the situation in both audition and mechanical vibration of the skin. Previous investigators, however, did not use more than one method on the same group of subjects.

There was no significant effect on the size of delta I/I resulting from the use of different frequencies of stimulation. Delta I/I was 0.052 at the 120% of RL standard intensity level, and 0.035 at 200% of RL.

The Weber fractions found in the present investigation were smaller than the values reported for audition and mechanical cutaneous vibration, but were of the same order of magnitude as the values reported for alternating current stimulation of the forearm.

Since it is possible that an electrical cutaneous communication system could be devised, an investigation was made of the number of absolute identifications of current intensity levels which could be made by the subjects. In order to select stimulus levels for identification which were subjectively equally spaced, and investigation was first made of the apparent magnitude of sensations produced by electrical cutaneous stimulation, by using S. S. Stevens' technique of direct estimation.

Median estimates of fifteen observers produced a linear relationship of log of current intensity to log of apparent magnitude of sensation. The estimates found in the present situation were not different for the two frequencies of stimulation used, and were essentially the same for both naive and experienced observers. The results indicate that sensation grows as the 3.5 power of the current.

Sets of two, three, four, and five intensity levels were selected for absolute identification, the levels being equally spaced in terms of apparent magnitude of sensation. Subjects could identify without confusion two levels. The channel capacity found in this study was about 1.20 bits.

The range of supra-threshold painless electrical energies is extremely narrow, the Weber fraction for intensity is relatively small, and with increase in intensity there is a much more rapid growth of sensation for cutaneous electrical stimulation than for any of the adequate stimuli. These findings support the hypothesis that electrical stimulation of the skin acts directly on cutaneous nerves, rather than on the cutaneous receptors.

Microfilm $2.00; Xerox $5.60. 113 pages.

RESPONSE PROBABILITY IN A TWO-CHOICE LEARNING SITUATION WITH VARYING PROBABILITY OF REINFORCEMENT

(L. C. Card No. Mic 59-4010)

Robert Hugh Hickson, Ph.D.
Indiana University, 1959

An experiment was designed to test the adequacy of certain predictions from Estes' statistical learning theory. The predictions were that: (a) the theory would adequately describe rate of learning and terminal response probability in a two-choice situation in which probability of reinforcement was varied according to an exponential function; (b) there would be no difference between "correction" and "forced-choice" groups; and (c) there would be no difference between groups having "trained" and "assumed" initial response probabilities. An incidental prediction was that a learning rate parameter (Θ) estimated from runway training would agree with estimates derived from pre-training in the two-choice apparatus.

The subjects (Ss), 120 female albino rats, were given bar-press training, with food reinforcement, in a runway to establish stable bar-press latencies. A 22 hour deprivation schedule was established for each S for the entire experiment. The Ss were than divided into six equal groups. Three of these groups were designated "correction" procedure groups, and the other three, "forced-choice" procedure groups. One of each of these sub-groups was given pre-training trials in a two-choice apparatus with response to one bar reinforced on 100 per cent of trials and response to the other bar never reinforced. Another group from each of the two procedural sub-groups was given 50 per cent of trials reinforced to one bar of the two-choice apparatus with the remaining 50 per cent reinforced to the other bar. The remaining group from each of the two sub-groups was not given pre-training in the two-choice apparatus.

Following this pre-training, all groups were given three trials per day for 30 days in the two-choice apparatus with probability of reinforcement changing over trials according to an exponential function from .50 to .67. Thus, Ss that had received no reinforced trials to one bar during pre-training were now reinforced on from 50 per cent to 67 per cent of trials for that bar-press response; Ss that had 50 per cent of pre-training trials reinforced to each bar were now reinforced on 50 per cent to 67 per cent of trials for one bar-press response, and 50 per cent to 33 per cent for the other bar-press response. The two groups that had received no pre-training were assumed to have initial response probabilities of .50 to each bar of the two-choice apparatus.

To evaluate response probabilities to each bar during pre-training and the varying probability of reinforcement procedure, a test-trial was given on alternate days. On this trial the S was reinforced for either bar-press response.

For the training series with varying probability of reinforcement the predictions concerning learning rates for the three correction groups were in close agreement with the empirically obtained results. The behavior of the three forced-choice groups did not confirm theoretical predictions concerning the slope of the acquisition curve. However, all groups appeared to substantiate the prediction that asymptotic response probability should match asymptotic reinforcement probability.

No differences were found among groups having "trained" and "assumed" initial response probabilities. Good agreement was found between $\underline{\Theta}$ estimates from runway latency data and pre-training two-choice behavior data.

With the exception of learning rates for the forced-choice groups, the results were interpreted as empirical verification of predictions from the Estes statistical learning theory model for the special case of varying probability of reinforcement.

Microfilm $2.00; Xerox $5.00. 96 pages.

TEMPORAL DISCRIMINATION IN DIFFERENT TYPES OF AUDITORY PATTERNS

(L. C. Card No. Mic 59-3841)

Jo Ann Smith Kinney, Ph.D.
The University of Connecticut, 1959

Very little empirical information can be found in the literature concerning the perception of patterns of sound, although such data are of obvious practical and theoretical importance. This problem, therefore, was examined experimentally by determining the effect of two major variables on the discrimination of temporal differences within patterns. These were the frequency separation of the elements in the pattern and the type of pattern, i.e., the way in which the elements were combined.

The basic pattern consisted of two tones of different frequencies separated by 50 msec of silence. In the other patterns, these same two elements were combined with other tones of different frequency or were simply repeated by themselves two or four times. Two frequency separations were employed, one in which the two tones of the basic pattern were of relatively near frequencies and the other in which they were separated by about two octaves.

A temporal variation in the arrangement of the tones was used to measure discrimination. In the standard condition the two tones of the basic pattern were separated by 50 msec of silence. This was compared, by means of the ABX method, with patterns in which the highest tone of the basic elements was displaced forward in time by 10, 20, 30 or 40 msec from the standard condition.

Subjects were, for the most part, students at the university of Connecticut; they were run in small groups and heard the stimuli over a loud speaker.

The main results from the study may be summarized as follows:

1) It is possible to measure discrimination in terms of the percentages of correct judgments at each of the various temporal separations since psychophysical functions are obtained whose percentages increase with increasing temporal displacement.

2) The frequency separation of the tones in the pattern affects this discrimination, the near frequency condition always producing better discrimination than the widely separated.

3) The type of pattern also affects the discrimination in that some patterns consistently yield better results than others. Non-repeated variations never improve discrimination beyond the level found for the basic elements and sometimes hinder it, while repetitions of the basic elements always improve discrimination.

4) Comparisons of results for the basic elements presented alone or imbedded in other tones reveal that the pattern effect depends to some extent upon the frequency condition. The imbedded elements always yield poorer discrimination in the far condition than the basic elements alone. In the near condition, however, only the triad produces poorer results; the ascending and pyramid patterns give the same results as the elements alone. Since the near condition is better for every pattern than the far, the size of the difference between near and far varies with pattern type.

5) Although the pattern created by two repetitions of the basic elements yields improved discrimination over that of the elements alone, both in near and far conditions, there is no additional increase with four repetitions. Furthermore, when empirical data are compared with curves predicted on the assumption that repeating a pattern gives the listener extra chances to detect the difference, the prediction based upon two repetitions gives better agreement than the one based upon four.

The relation of these results to those of other studies is discussed, as are the possible explanations for the specific pattern effects. The general agreement between these results and those of visual form perception is pointed out. Suggestions are made for further research to test the implications of this experiment.

Microfilm $2.00 Xerox $4.60. 89 pages.

SOME PARAMETERS OF VISUAL APPARENT ABIENT MOVEMENT

(L. C. Card No. Mic 59-2641)

Melvin Levitt, Ph.D.
Michigan State University, 1957

This investigation was conducted with the purpose of exploring the parameters of stimulation necessary for the perception of optimal abient movement. Two simple luminous targets were exposed in succession, each being located at the same optical distance and with their centers on the principal visual axis. The first target was of constant area and intensity; for different exposure sequences the second was made to vary in area or intensity. The temporal relation between termination of the first exposure and initiation of the second exposure was serially varied, thereby producing varying degrees of unstimulated interval between exposures and varying degrees of temporal overlap of exposures. Monocular viewing was employed, and stimulation was localized in the fovea.

Threshold measures for the magnitudes of both the unstimulated interval between exposures and the interval of temporal overlap indicate that there is a range of relative differences in both stimulus area and intensity within which movement is perceptible. Within these ranges, the absolute values of the threshold measures of the temporal relation between exposures were found to lawfully increase as direct functions of both relative difference in area and intensity. An important provision was the exposure of both targets above minimal durations.

Collateral observations revealed an orderly variety of related phenomena. These were: continuity of light (fusion), discontinuity of light (flicker), intrusion of the smaller

second square within the first, contour obliteration resulting in either of two forms of pure movement, and the total obliteration of the effect of the first stimulus. Each of these phenomena was semiquantitatively discussed in relation to the parameters of stimulation.

The interpretation of all phenomena reported is made in terms of a tentative, primitive conceptual scheme, which not only embraces these phenomena, but applies in part to aspects of flicker fusion and contrast phenomena. It is believed that this scheme is capable of generating testable predictions. Microfilm $2.00; Xerox $3.80. 68 pages.

SALT DRIVE AND ITS PROPERTIES IN ADRENALECTOMIZED RATS

(L. C. Card No. Mic 59-3847)

Melissa Lewis, Ph.D.
The University of Connecticut, 1959

The following experiments were designed to see whether salt drive has properties common to other appetitive drives. The properties tested were a drive's (1) ability to mediate learning of a new habit, (2) change in strength with satiation and deprivation, (3) ability to maintain an old habit under different schedules of reinforcement, and (4) discriminability from other drives.

The salt drive was produced by depriving bilaterally adrenalectomized rats of sodium chloride (NaCl). With this method a salt drive can be developed quickly, and readily manipulated.

In experiment I 24-hour NaCl-deprived, adrenalectomized rats, and sated normal rats were placed in Skinner-type boxes for 90 minutes and allowed to bar press for 1% NaCl with 100% reinforcement.

The normal rats did not learn to press for 1% NaCl whereas the NaCl-deprived adrenalectomized rats showed a significant increase in bar pressing rate from the first to the second 30 minutes. During the final 30 minutes of pressing the rate fell. That the fall is probably due to satiation and not fatigue is indicated by the results from a second group of adrenalectomized rats. They were tested under the same conditions except that they remained in the boxes for 210 minutes with 100%, interval and finally random ratio reinforcements. In 210 minutes they received less NaCl than the first experimental group did in 90 minutes. The second group's rate of pressing after 2-1/2 hours when ratio reinforcement was instituted became significantly greater than the rate ever attained by the first experimental group. This suggests that the first group was not fatigued, but becoming satiated after 90 minutes of bar pressing.

The bar pressing of the second group of experimental rats also demonstrates that under salt drive as under other appetitive drives, an old habit can be maintained by interval and ratio reinforcements.

Experiment II was designed to measure the possible change in drive strength with change in deprivation. Adrenalectomized rats were deprived of NaCl for 0, 3, 6, 12 or 24 hours and given the following tests: (1) bar pressing for 1% NaCl for 9 minutes, (2) drinking of 1% NaCl adulterated with increasing concentrations of quinine, and (3) consumption of 1% NaCl for 15 minutes.

Only the consummatory test unequivocably showed an increase in salt drive strength with increasing NaCl deprivation. The 24-hour bar pressing rates approached a significant increment over the 0- and 3-hour rates, but the quinine-NaCl drinking scores showed no correlation with hours of deprivation.

Experiment III tested whether salt drive is discriminable from a drive for food in general. Adrenalectomized rats were trained to criterion in a T-maze to run to one arm for 1% NaCl when NaCl deprived, and to the other for 10% sucrose when food deprived. Then the two drives were randomly alternated and the rats run and given the reward appropriate to the drive.

Nine rats, of the 15 retained to the end of the experiment, learned the discrimination between salt and food drives. The performance of the group was significantly above change level. The discrimination was made although the two goal responses were ostensibly the same.

The experiments above demonstrated that a salt drive can be readily produced and manipulated and thus lends itself to further study of problems in learning and motivation, that salt drive has properties common to other appetitive drives. The properties demonstrated are: (1) mediation of a new habit, (2) change in drive strength with satiation and deprivation, (3) maintenance of an old habit with different schedules of reinforcement, and (4) discriminability of drives. Microfilm $2.00; Xerox $3.00. 51 pages.

A STATISTICAL LEARNING ANALYSIS OF FIGURAL AFTER-EFFECTS

(L. C. Card No. Mic 59-4021)

Harry Lee Madison, Ph.D.
Indiana University, 1959

In a figural after-effects experiment, an inspection-figure, I, is presented. After its removal, a test-figure, T, is presented. Under certain conditions, the properties of T, as reported by a subject, are distortions of its physical properties.

From a statistical learning model for figural after-effects experiments, seven properties of figural after-effects phenomena are derived:

I. Initially, neither the response of going toward I nor the response of going away from I will dominate.

II. Near I, dominance of the response going toward I will be established.

III. Response dominance is established gradually in time.

IV. Most conditioning will occur near I. Consequently, little response dominance will be established far from I.

V. When T is present, principles II, III, and IV apply with T substituted for I.

VI. Between inspection of I and presentation of T, the dominance established in the presence of I will diminish gradually.

VII. Response dominance is measured as displacement.

With these principles, the effects in figural after-effects literature can be explained.

The learning analysis suggests stimulus modification of figural after-effects. This was investigated by introducing extraneous cues, randomly scattered dots, near I.

In Experiment 1, two inspection-figures were used: I_p, a plain 60 mm circle, and I_i, a 60 mm circle with dots inside. T was a plain 40 mm circle. Displacement, a reported apparent shrinkage of T, was measured from each of four subjects after 28 presentations of each inspection-figure for 30 seconds. I_i led to greater displacement than I_p.

In Experiment 2, three inspection figures were used: I_p, a plain 40 mm circle, I_i, a 40 mm circle with dots inside, and I_o, a 40 mm circle with dots outside. Displacement was measured on each of three subjects after 14 presentations of each inspection-figure for 30 seconds. No significant displacements were found.

In Experiment 3, the four subjects of Experiment 1 were given 28 presentations of a new inspection-figure, I_o, a 60 mm circle with dots outside. The results, combined with those of Experiment 1, show that displacement following I_o is intermediate between displacements following I_p and I_i.

From the data of the three experiments, three hypotheses concerning the role of the dots as stimuli are considered and evaluated. If the dots function as ordinary stimulus components, the expectation in Experiment 1, predicted on the basis of stimulus-generalization, is opposite to the observed results.

If the dots affect the apparent size of I, differential displacements should occur in Experiment 2, but no displacement at all is observed.

From the data of Experiments 1 and 2, an hypothesis that the dots speed up learning, but lack other stimulus properties, if formulated. Experiment 3 constitutes a further test of this hypothesis and the observations are consistent with the hypothesis.

In the appendix, a possible behavioral basis is presented for the events postulated in the statistical learning model for figural after-effects.

Microfilm $2.00; Xerox $4.00. 73 pages.

A FACTOR-ANALYTIC STUDY OF MILITARY LEADERSHIP

(L. C. Card No. Mic 59-1855)

Alvin Marks, Ph.D.
University of Southern California, 1959

Chairman: Professor William B. Michael

This study was designed to investigate the relationship between intellectual aptitudes and military leadership. It was also designed to develop a rating scale which would accurately evaluate the degree of possession of these aptitudes within the individual military leader.

It was hypothesized that eleven aptitudes were important to military leadership. These factors were perceptual foresight, conceptual foresight, penetration, experiential evaluation, sensitivity to problems, adaptive flexibility, spontaneous flexibility, general reasoning, verbal comprehension, originality, and ideational fluency.

Nineteen tests which were considered to be relatively pure measures of the hypothesized factors were administered to 204 Marine officers. Scores were intercorrelated and the matrix factor analyzed. This was followed by graphic rotations, using the triple criteria of positive manifold, simple structure, and psychological meaningfulness.

Each officer tested was rated on the specially developed rating scale by two peers and two superiors. The scores were intercorrelated for the combined peer ratings and separately intercorrelated for the combined superior ratings. The two matrices were factor analyzed separately by the method described above.

Results. All hypothesized aptitude factors emerged and all tests except one loaded on the hypothesized factor. All of the factors were relatively independent except penetration, which might be a second-order factor.

Five factors emerged for the peer ratings: ruggedness, leadership, competence, intellectual, and a halo factor. The same factors emerged for the superior ratings with the exception of the intellectual factor.

The rating factor intellectual predicted most of the aptitude factors significantly. The other rating factors did not predict significantly except in one or two cases.

There appeared to be no relationship between degree of possession of an aptitude factor or combinations of aptitude factors and relative standing as a military leader; i.e., the criterion (leadership rating) failed to predict possession of these factors.

The rating scale was unable to accurately measure individual possession of factors, although the intellectual factor derived from the rating scale predicted most of the aptitude factors significantly.

Peers and superiors seemed to interpret the rating scale in a similar manner except for the intellectual items. The peers interpreted these items as a separate dimension, while the superiors did not.

The rating scale scores showed an essentially normal distribution on all items. This is significant in that other methods of evaluating leadership in the Marine Corps have consistently shown a negatively skewed distribution with most officers falling in the excellent to outstanding categories.

Conclusions. The results of this study lead to the following summarized conclusions: (1) The postulated aptitude factors do exist in a military population. (2) The relationship of these factors to military leadership is negligible. (3) The rating scale constructed to measure the degree of possession of the aptitude factors was unable to do so. (4) Peers and superiors generally agree as to implications of the rating scale gut do not agree as to who possesses which factors and to what degree they are possessed. (5) Peers are more impressed by intellectual behavior than are superiors. (6) Penetration is probably a second-order factor. (7) The aptitude measures used in this study are relatively pure measures. (8) Of the rating items used in this study, verbal comprehension ratings are the best predictors of aptitude factors. (9) Both peers and superiors rate officers as to leadership ability along a continuum which shows an essentially normal distribution. (10) Leadership may have to be regarded as a property of behavior rather than of persons.

Microfilm $2.00; Xerox $5.80. 116 pages.

SOME BEHAVIORAL EFFECTS OF A RANDOMLY ALTERNATING TWO-VALUED TEMPORALLY DEFINED SCHEDULE OF REINFORCEMENT

(L. C. Card No. Mic 59-4081)

John R. Millenson, Ph.D.
Columbia University, 1959

An attempt has been made to treat the problems of systematization and experimental specification of the rather broad class of reinforcement schedules for operant behavior included under the rubric of variable schedules. An approach to these schedules--which involve contingencies not simply repeated from reinforcement to reinforcement--has been outlined in which such schedules are cast into a temporally defined framework of experimental variables. In this framework, one temporal variable (t^D) is correlated with a non-zero probability of reinforcement for operant responses, and a second variable (t^Δ) is correlated with a zero probability of reinforcement. Two analytic variables, defined in terms of the fundamental ones, $t^D + t^\Delta = T$ (termed cycle length), and $t^D/(t^D + t^\Delta) = \overline{T}$ enter into the specification of a schedule which may be considered as the simplest and limiting case of variable schedules generally. In this schedule, in all other ways identical to previously studied temporally defined schedules, two different values of cycle length, T_A and T_B alternate in random order. The properties of this schedule, it was argued, justify a more intensive analysis of its behavioral effects for their implications for more complex variable schedules.

Two experimental treatments were described in which the rate of key pecking responses of pigeons exposed to such two-valued cycle schedules was measured as a function of two of the possible parameters. In treatment I, six groups of three birds each were exposed to successive two-valued reinforcement schedules containing cycles of 2 min. or 0.5 min. duration in which $\overline{T}$ was progressively reduced from 1.0 to .003125. Each group was correlated with one of six (.05, .10, .40, .60, .90 or .95) different fixed values of the relative proportion (termed $\overline{P}$) of longer (2 min.) cycles for the duration of the treatment. In Treatment II, two birds were exposed to successive schedules differing in $\overline{P}$, in which $\overline{T}$ remained fixed at unity.

The findings and conclusions of these treatments were:

1. Throughout 60 days exposure to $\overline{T} = 1.0$, there was a rise in response rates. This rise continued for many birds through $\overline{T}$ values that did not appreciably affect reinforcement frequency, and in many birds a leveling off in response rate was not seen until after 100 consecutive sessions.

2. As $\overline{T}$ was progressively reduced, nearly all birds showed an increase in key pecking rates. The rate of change of response rate, however, appeared to depend on $\overline{P}$, with birds in $\overline{P}$ group .40 showing the largest increases in rate, and birds in $\overline{P}$ group .60 showing the smallest increases.

3. Low rates at all $\overline{T}$ values, and small increases in rate with $\overline{T}$ changes of $\overline{P}$ group .60, were associated with a local rate picture evidencing short pauses after reinforcement but otherwise was nearly free from further temporal discriminations and other systematic deviations. This linearity of response rate found here with only two cycles matches closely behavioral effects seen hitherto only in more complex schedules with many more programmed intervals.

4. Cumulative response curves indicated that birds at values of 1.0 $\overline{P}$ .90 and .10 $\overline{P}$ 0 gave records similar to birds on fixed cycle schedules of 2 min. and 30 sec. respectively. Birds on $\overline{P} = .40$, however, gave abrupt shifts and inflections in rate characteristic of "mixed" schedules, while birds on $\overline{P} = .60$ showed overall and local rates characteristic of birds on high arithmetic VI schedules.

5. The two birds in Treatment II exposed to successive schedules differing in $\overline{P}$ did not give overall response rates or cumulative curves consonant with Treatment I animals that were exposed to the same schedules without such prior schedule histories. The durability of these particular results suggests that past history with other reinforcement schedules may influence and modify permanently the effects seen under new schedules. In addition, the direction of the rate changes occurring with $\overline{P}$ changes made on single birds--opposite from the prediction made on the basis of the Treatment I group differences in rate at various fixed $\overline{P}$'s--calls into question the validity of group functions for predicting the behavior of individual organisms.

Suggestions towards directions for future investigations were given. Microfilm $2.00; Xerox $5.20. 103 pages.

STIMULUS GENERALIZATION IN COMPLEX VERBAL BEHAVIOR

(L. C. Card No. Mic 59-4239)

William Edward Montague, Ph.D.
University of Virginia, 1959

The analysis of behavior poses two major problems for psychologists. First there is the methodological problem of response specification which is important in guaranteeing the reproducibility and recognition of responses on repeated occasions. The second problem is concerned with whether a response as specified is a useful descriptive unit. It is suggested that this depends upon whether a response's probability can be demonstrated to be lawfully related to systematic variations in independent variables. It is suggested further that the extent to which a number of responses specified in different ways are shown to be related to independent variables in the same way provides evidence for the importance of this relationship: (1) in defining a descriptive unit of behavior, and (2) in the classification of responses for a functional analysis of behavior.

In previous experiments, three differently specified responses have been shown to vary lawfully with changes in reinforcement. The present experiments attempt to demonstrate that these differently specified responses, in tests for stimulus generalization, are related in the same fashion to variations in similarity.

Groups of subjects performed three tasks which differed in their specification and complexity, but whose proper execution required the subjects to respond in terms of the same discriminative stimuli. The subjects in Group I learned to make a choice between pressing a right or a left button in terms of the shape of an ellipse. The tasks for Group II and III involved matching-to-sample problems in which subjects learned to choose between two geometrical figures on the basis of two properties in a sample

figure. The main difference between the two groups was that the subjects of Group III had to make a choice depending on a third property in the sample. In both groups, however, the "correct" choice depended upon the shape of an ellipse appearing at the time of choice.

The subjects in all groups received training in their tasks on two days. Following training on the second day they were run for a series of test trials during which the shapes of the ellipses were varied systematically. During the test probability of response was estimated by measuring their latency and frequency of occurrence. The stimuli during both training and testing were arranged sequentially on strip film and presented automatically by means of a strip film projector.

It was expected that response probability would decrease with increasing differences between the original and test stimuli. This trend was expected to be revealed by similar gradients of generalization for the three groups regardless of the differences in their specification.

The results failed to substantiate such an expectation. The response probabilities did not vary in the same fashion for the three groups. Not only were significant differences found between the generalization curves for the three groups, but only Group I showed significant generalization.

Since the tasks for Groups II and III were more complex than the task for Group I it was thought that the limited training of these two groups might account for the failure to obtain the expected results. A second experiment was performed to test this assumption. The procedure was exactly the same as for the first experiment except that two and nine days of training were given to Groups II and III, respectively, and only latency measures were obtained.

With the additional practice trials the expected results were obtained. The data show significant generalization for both groups. When the results for Group I from the first experiment are combined with Groups II and III of the second, an analysis reveals that there are no significant differences between the generalization curves for the three groups. That is to say, the responses made by the subjects in all groups varied in the same manner with variations of stimulus similarity.

The analysis of the combined results in encouraging. The different responses were shown to be comparable in terms of their relationship to stimulus similarity. These results taken together with those of the previous experiments showing the responses to be related in the same way to reinforcement demonstrate that these responses are comparable units for the analysis of behavior.

Microfilm $2.00; Xerox $4.00. 75 pages.

THE RHINENCEPHALIC REPRESENTATION OF TASTE IN THE ALBINO RAT

(L. C. Card No. Mic 59-4352)

Gordon Rolfe Morrison, Ph.D.
Brown University, 1959

An hypothesis was suggested regarding the neuroanatomical and neurophysiological bases of primary positive reinforcement. With respect to this hypothesis three experiments were done to investigate the role of the rhinencephalon in determining taste preference behavior. It was found that ablation of a small area of the prepyriform cortex decreased the rats' preference scores for various concentrations of sodium chloride. No consistent results were obtained for a change in aversion to quinine hydrochloride.

The neural areas involved correspond to those designated by Krieg as prepyriform areas 51e and 51f and possibly Cingulate area 25.

Following from the results of the study some additional suggestions and predictions were made extending the hypothesis formulated in the introduction.

Microfilm $2.00; Xerox $5.80. 117 pages.

THE SPECIFICATION OF CHIMPANZEE VOCALIZATION

(L. C. Card No. Mic 59-3560)

John Wilson Nichols, Ph.D.
The University of Florida, 1954

Tape recordings were made of chimpanzee vocalizations and sound spectrograms were prepared from the recordings. The tape recordings were played to human auditors who attempted to specify the sounds heard in phonetic terms. There was little agreement among the auditors in their choice of terms for a given sound represented on the spectrographic record. It was concluded that if phonetic and spectrographic analysis of chimpanzee sounds are to be used conjointly, the spectrographic record should constitute the primary data.

Microfilm $2.00; Xerox $5.00. 100 pages.

POSITION DISCRIMINATION AND REVERSAL LEARNING SET IN MENTALLY RETARDED CHILDREN

(L. C. Card No. Mic 59-3858)

Robert Orlando, Ph.D.
The University of Connecticut, 1959

Serving as part of a programmatic investigation of learning and transfer processes in mentally retarded children, this study was designed to demonstrate learning set in a free-operant, position discrimination reversal situation. The apparatus consisted of a conditioning booth modeled after the Skinner-Lindsley type with automatic controls for scheduling reinforcements and recording responses.

Mentally retarded children within the M.A. range of two years to six and one half years participated in two experiments. Experiment I provided a test of Estes'

statistical model for competing reactions. Experiment II incorporated several variables that were expected to affect the course and/or magnitude of the learning set effect and provided for analyses of accompanying retention data.

The results of Experiment I indicated that the model proposed by Estes is adequate in fitting theoretical curves to acquisition data in a simple position discrimination reversal situation with human subjects. The hypothesis which the model was constructed to test, that the form of the conditioning curve is to a large extent determined by the concurrent extinction of competing reactions, has received additional confirmation.

Learning set was clearly evident in Experiment II. Of the major parameters in the experiment, only schedules of random ratio reinforcement significantly affected learning performance although mental age level differences approached significance.

The following is a list of the major conclusions based on the results of Experiment II:

(a) The "hump" effect commonly observed in the reversals situation is probably due to a difference in the relative strengths of the incorrect response tendencies in the original learning as compared with reversal learning,

(b) The general level of performance in a reversals situation is a function of the resistance to extinction of the habits learned,

(c) Contrary to the hypothesis that learning set formation provides an index of phylogenetic status, learning set was found not to be a function of the mental age of sucjects in the imbecile range,

(d) Learning set does not depend on the acquisition of habits of responding to perseverative reinforcement cues,

(e) A mechanism of transfer suppression might be responsible for learning set formation,

(f) Some evidence suggests that partial reinforcement schedules change the nature of the response involved rather than affect the resistance to extinction of habits learned.

Microfilm $2.00; Xerox $5.00. 99 pages.

PARTIAL REINFORCEMENT AND GENERALIZATION

(L. C. Card No. Mic 59-4259)

Henry C. Rickard, Ph.D.
The University of Tennesses, 1959

Major Professor: G. M. Pascal

(1) Experiment I was designed to determine the operant level of "yes" responding in a free choice situation where "no" was the only other possible choice. It was found that the undergraduate population sampled has a tendency to respond "yes" more often than "no", but that there is adequate room for "yes" responding to increase or decrease as the result of experimental treatment which might be applied.

(2) Experiment II was a pilot study designed to investigate the effects of different frequencies of random reinforcement upon extinction under conditions of stimulus generalization. The same students employed in Experiment I were used in this study. The Ss were conditioned, under two schedules of reinforcement (12.5 and 100 per cent) to "yes" responding in a free choice situation where "no" was the only other possible choice. Half of the Ss in each reinforcement group were extinguished under conditions of no cue change, and half were extinguished under conditions of cue change. This experiment adds to the data from other studies (Jenkins and Stanley, 1950) which clearly demonstrate the greater resistance to extinction of partially versus continually reinforced Ss. The hypothesized cue change effect appeared to some extent but this effect was not striking. In the basic comparison which led to the design of Experiment II: the comparison between the 12.5 per cent changed versus the 100 per cent changed groups, the superiority of the 12.5 changed groups emerged as predicted.

(3) Experiment III was an extended replication of Experiment II but involved three frequencies of random reinforcement (25, 50, and 75 per cent) and three degrees of cue change (unchanged, moderate, and extreme). Both the reinforcement variable and the cue change variable were significant. The interaction effect was not significant. There was significantly greater generalization for the groups conditioned under low frequencies of reinforcement if generalization is defined as greater response strength under conditions of stimulus generalization. When a correction is made for the greater absolute strength potential of the low reinforcement frequency groups, however, the generalization effect approaches but does not meet the usual accepted levels of significance.

Microfilm $2.00; Xerox $5.20. 101 pages.

THE TEMPORAL DISTRIBUTION OF RESPONSES ON FIXED INTERVAL SCHEDULES

(L. C. Card No. Mic 59-4090)

J. Gilmour Sherman, Ph.D.
Columbia University, 1959

This study was designed to investigate the distribution of responses within intervals on fixed interval schedules of reinforcement. Twelve male albino rats served as subjects. The animals were conditioned in a bar-pressing situation, two animals at each of six fixed interval lengths (1/6, 1/2, 1, 2, 4, and 9 minutes). The successive training procedures involved were: (1) three days of operant level determinations, (2) one day on which ten regular reinforcements were delivered, (3) sixty days of fixed interval conditioning during which each animal was run for 100 intervals per day, and (4) five one-hour sessions of extinction.

Throughout experimentation all animals were maintained at 80% of ad libitum body weight and were fed 16 hours prior to the daily experimental session. Data for each animal were collected to indicate: the total number of responses per day, the distribution of responses within individual intervals, and the distribution of responses across the 100 intervals of each daily session.

The major findings were:

1. The day-to-day variability in response rate for any given animal does not appear to decrease with training.

2. The temporal pattern of responding shows considerable day-to-day stability for any given animal after extended FI training. An inter-reinforcement response distribution measure is suggested as a possible stability criterion since the form of the "final" distribution is similar irrespective of FI length, and is unaffected by changes in response rate.

3. Individual inter-reinforcement response distributions, after extended training take the form of a break (zero rate) after reinforcement, followed by an abrupt change to responses emitted at a constant rate.

4. When the median break time of the 100 daily fixed intervals is plotted as a function of interval size, the relationship appears to be linear. This is a stable characteristic of late FI performance.

5. For a given animal, responding when it occurs, tends to be at a rate that is constant both from interval to interval and from day to day.

Microfilm $2.00; Xerox $4.40. 82 pages.

EXPERIMENTS IN CONDITIONING OPERANT VERBAL BEHAVIOR

(L. C. Card No. Mic 59-4263)

Edwin O. Timmons, Ph.D.
The University of Tennessee, 1959

Major Professor: William O. Jenkins

The study was comprised of a series of experiments utilizing the methodology of operant conditioning with verbal responses used as the manipulated behavior. Four sections comprised the study; though related, they were independent experimental entities.

A. Sample of the Operant Verbal and Drawing Behavior of Undergraduates at The University of Tennessee

Each of 12 Ss gave 100 single words and 25 sentences in a small, private office used later for the experimental portions of the project. No treatment was given any of the Ss. The 1200 word sample of single words was analyzed for the following: (1) frequency of occurrence of each part of speech, (2) assessment of sex differences, order effects, and written vs. oral methods of collecting data, (3) frequency of occurrence of each letter as the initial letter, (4) intensive study of the letter "S" as initial letter, and (5) frequency of words referring to buildings. The sample of 300 sentences yielded (1) length of sentences, and (2) frequency of self-reference sentences. The drawing data produced (1) subject matter of drawings, (2) subject matter differences when drawings are collected in group or individual settings, and (3) special attention to the number of drawings containing buildings.

This information was used to isolate a number of factors which may be used as dependent variables. Words beginning with the letter "S" were chosen as the dependent variable for the experiments described in B and C; words pertaining to buildings as well as drawings with buildings in them were the factors focused on in the experiment presented in D.

B. Inducing Verbal Conditioning

Eight experimental conditions were formed by creating arbitrary "much" and "little" dimensions on each of three parameters of conditioning: (1) amount of instructions, (2) kind of reinforcement, and (3) schedule of reinforcement. The task was learning to say words beginning with the letter "S". Amount of instructions, the first parameter, proved to be the overwhelmingly powerful variable in inducing learning of the task. Groups receiving more cues for performing learned quicker, but all groups tended to show improvement over operant level performance.

C. Comparison of Four Methods of Weakening Verbal Behavior

After 20 Ss were conditioned to say "S-words" to a common criterion of learning, they were placed with no signal into one of four treatment groups: (1) Extinction, or omitting "Right" from formerly correct words; (2) "Punishment," or following formerly correct words with "Wrong"; (3) Counter-conditioning, or rewarding formerly incorrect responses with "Right"; and (4) a combination of "Punishment" plus Counter-conditioning. Borne out was the hypothesis that increasing amounts of cue change from the conditioning phase to the weakening phase will cause an increasing rate of behavior loss.

D. The Effect of an Unconsciously Learned Verbal Habit on a Related Nonverbal Behavior

Ss were asked to say single words; they were reinforced for saying words relating to buildings on a 75 per cent aperiodic schedule. The schedule was administered by "feel," for early in conditioning nearly all "building-words" were reinforced; later, few were reinforced to prevent the Ss from discovering the selected category. Reinforcing stimuli were mild, affirmatory words such as "Unh-huh, O. K., Yeah." Ss were asked to "Draw something" after treatment. The number of buildings drawn by the Experimental Group was compared to the operant level of drawings and results were extremely significant even though none of the 10 Ss could verbalize the selected category or a relationship between his saying words and what he drew.

From the results as a whole, it is obvious that the principles and methods of operant conditioning are well suited to experimentation with verbal behavior.

Microfilm $2.00; Xerox $6.60. 139 pages.

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THE EFFECT OF STABILIZED AND NONSTABILIZED HUNGER DRIVE, AGE, AND SITUATION COMPLEXITY UPON EXPLORATORY BEHAVIOR

(L. C. Card No. Mic 59-4265)

Stanley Wechkin, Ph.D.
The University of Tennessee, 1959

Major Professor: Ernest Furchgott

An experiment was conducted to ascertain the effects of nonstabilized food deprivation, stabilized food deprivation, runway complexity, and age on exploratory behavior of male albino rats both during and across five five-minute trials. Three levels of deprivation: zero, twenty-three, and forty-seven hours were used. The stabilization dimension included groups stabilized on the twenty-three hour schedule for zero and fourteen days prior to the beginning of the experiment. The two age groups were respectively about thirty-five and ninety days old at the beginning of the experiment. All groups were equally divided into simple and complex runway groups. The simple runway groups were exposed to a fifteen foot straight runway, the complex group to a runway different only in that there were right angle turns every twelve inches. The only measurement taken was the number of twelve-inch runway units traversed during each minute of the trials. The data were analyzed for differences in trend for the total trial sums and for intratrial effects.

The major findings are as follows: 1) There were no significant differences for degree of deprivation, stabilization of deprivation or age when the group sums were taken exclusive of trials. 2) There was a suggestion of decreasing exploration with increasing deprivation for the complex runway groups. 3) The forty-seven hour deprived groups showed a marked increase in exploration after the third trial. 4) There was a significant difference favoring runway counterpart. 5) There was a suggestion of an age-complexity interaction; the young Ss starting low and showing increased exploration, the older Ss either remaining the same or showing decreased exploration. 6) The across-trials shape of the summed group curves was curvilinear with a minimum at about the third trial. 7) The intratrial curves for all groups showed that Ss in all groups showed the greatest decrease in exploration at the beginning of the trial with little subsequent change, and that there was an increase with the beginning of a new trial. 8) The percentage of subjects showing decline during the intratrial intervals was greater for the complex runway groups than for the simple runway groups.

An attempt was made to explain some of these findings. Others were simply allowed to stand by themselves. Future experiments with these variables were suggested, with particular emphasis on trial effects.

Microfilm $2.00; Xerox $4.80. 92 pages.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

HANS NIELSEN HAUGE AND RELIGIOUS LAY ACTIVITY IN NORWAY

(L. C. Card No. Mic 59-2219)

Silas Elliot Bergstad, Ph.D.
New York University, 1959

Chairman: Professor Lee A. Belford

Statement of the Problem

The purpose of this investigation is to examine the religious views and activities of Hans Nielsen Hauge in relation to the development of religious lay activity within the State Church of Norway.

Procedure

The religious views of Hans Nielsen Hauge were compared with the authoritarian position of the State Church of Norway, using three categories taken from Hauge's writings. Hauge's activities and the Haugean revival were analyzed through a comparison of conditions in Norway before and after the time of Hauge. The principles of the Haugean fellowship were identified through the writings of Hauge, primarily his "Testament to His Friends." The development of organized lay activity in Norway, since the time of Hauge, was traced from the organization of the first missionary societies to the establishment of national missionary federations. The doctrinal position and functional program of four leading missionary federations in Norway today were compared with that of the original Haugean movement, and the similarities pointed out. Finally, the significance of Hauge's views and activities for American education and church activity was pointed out, and suggestions made for further study of the Haugean movement and its contribution to the development of religious lay activity in America.

Findings and Conclusions

1. Hauge's religious views regarding: 1) Man's personal salvation, 2) Man's personal participation in religious activity, and 3) Man's personal responsibility for the spiritual welfare of others, were found to be basically in harmony with the doctrinal position of the Norwegian Church, as stated in its confessional writings.

2. The study revealed that Hauge's communicative activities, oral and written, covered the entire land of Norway. His administrative activities established a pattern that has affected the organization of lay activity to the present day, especially in the areas of administrative supervision and in-service training.

3. The Haugean revival produced definite observable changes in Norwegian life and culture, as a result of the activities of Hauge and his associates. These changes are noticeable in the lives of individuals, in the form of new religious experiences and participation in religious activity, and in the Church, in the form of a functional program of activity.

4. The guiding principles of the Haugean fellowship, the association of Hauge's followers, served to consolidate the gains of the Haugean revival. These principles, with their emphasis on Lutheran doctrine and a functional program of activity, also became the foundation for organized patterns of lay activity since the time of Hauge.

5. The so-called "Haugean heritage," with its doctrinal and practical emphasis, is observable in the doctrinal position and functional program of leading lay organizations in Norway today, notably the following four national missionary federations: The Norwegian Missionary Society, The Norwegian Lutheran China Mission Federation (now changed to The Norwegian Lutheran Mission), The Norwegian Lutheran Inner-Mission Society, and The Western Inner-Mission Federation.

Microfilm $3.30; Xerox $11.20. 253 pages.

AN APPRAISAL OF CURRENT PROCEDURES USED IN TEACHING INTRODUCTORY BIBLE COURSES IN SELECTED LIBERAL ARTS COLLEGES

(L. C. Card No. Mic 59-2079)

Richard Raymond Bredenberg, Ph.D.
New York University, 1959

Problem and Limits: The investigator attempted to answer the question: "What can be done to improve the quality of instruction in college Bible courses?" Twenty-seven instructors, who were recognized by their peers as being effective teachers, and 1264 students completed questionnaires designed specifically for this study.

Procedure: The objectives of the selected instructors were surveyed. Similarly, the objectives which the students of these instructors believed to be important in a college Bible course were examined and compared with those of the instructors. The approaches, methods, practices, and materials employed by the instructors were determined. The extent to which these were useful in meeting two general objectives was then measured. Those objectives were: (a) the communication of Biblical content; (b) the development of moral and religious insights.

Findings and Conclusions: (a) In several areas the desires of students were different from the aims of the instructors. Students were primarily concerned with the relation of the course to their religious faith; whereas instructors placed major emphasis upon purely academic matters. Students preferred an emphasis upon ideas rather than facts. They were also primarily interested in a professor's communicative ability; whereas the instructors were more concerned with subject-matter competence. Students preferred that an instructor indicate his personal Biblical interpretations rather than envelop himself in objectivity. They indicated that a Christian commitment was not

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essential for adequate understanding of the Bible nor was it a primary qualification for the Biblical instructor. (b) The lecture was the students' and instructors' first choice of classroom methods which help communicate Biblical content. It was not as effective in assisting the student to gain moral and religious insights as were two methods involving more active student participation--group discussion and student-initiated questioning. Students and instructors were agreed that a variety of teaching methods is needed. (c) Of the extra-classroom activities evaluated, reading assigned Biblical material, reading the assigned textbook, and preparing for examinations proved to be highly profitable activities for the student to gain a knowledge of Biblical content. However, only the reading of the Bible was considered by the students to be a highly effective activity for gaining moral and religious insights. Preparation for examinations was rated the lowest of all the designated extra-classroom activities in this regard. (d) The extent and variety of materials used by instructors was not great. The use of audio-visual material did not receive a high rating as an instructional method. However, where audio-visual materials were used with more than the usual frequency, students rated the value of the method more highly. (e) Three texbooks proved to be effective in meeting both objectives. They were: Essentials of Bible History, Exploring the Old Testament, and The Dartmouth Bible. However, the study demonstrated that where a textbook was adopted, the Bible was read with considerably less frequency than where a textbook was not employed. (f) The portion of the investigation most helpful to a Bible teacher, contains a listing of individual practices used to good advantage by the instructors of this survey. They cannot be summarized except to say that students were very conscious of instructors' attitudes as well as of their classroom procedures.

Microfilm $2.30; Xerox $8.00. 173 pages.

MAN AND SOCIETY IN THE QUMRAN COMMUNITY

(L. C. Card No. Mic 59-4100)

Harry Allison Butler, Ph.D.
Vanderbilt University, 1959

Supervisors: Professor J. Philip Hyatt and Professor Lou H. Silberman

Purpose.--The aim of this study is to determine the nature of the Jewish community at Qumran described in the Dead Sea Scrolls, especially the nature of the social relationships and obligations within the group and the attitudes of this community towards outsiders.

Sources.--This study is based upon an examination of photographic copies of all the published non-Biblical Hebrew texts of Cave One and Four as well as the previously known Zadokite Document of the Cairo Genizah, together with numerous translations of the original texts into English, French, and German.

Methods.--This work is limited in its scope and does not deal extendedly with the problems of dating the scrolls, identifying the historical characters and events, or comparing the Qumranites with other known Jewish sects. That all of the scrolls date from one period and originate within the same Jewish community is recognized in the beginning of the study only as a possible, though popular, assumption. Therefore, the author is careful to treat each text separately so as to facilitate recognition and comparison of the distinctive characteristics of each document.

Subjects.--The five major divisions of the work are (1) names and titles, (2) organization, (3) authority, (4) practices, and (5) ethics of the Qumran community.

Results:--A unifying theme discovered in nearly all the scrolls examined is the conflict motif, of which three variations can be distinguished: (1) an actual historical conflict, as described in the Zadokite Document, the Hymns, and the commentaries; (2) a futuristic, holy war in which a reunited Israel participates, described in the War Scroll and implied in the Rule of the Congregation; and (3) an ethical conflict within the hearts of men, as seen in the Manual of Discipline. The Qumran community was formed after the historical schism resulted from a dispute between the Teacher of Righteousness and the Wicked Priest over the question of the Teacher's authority to interpret the Torah. The scrolls which are concerned with this conflict are considered to be earlier than the other scrolls in which the conflict idea has developed into more spiritualized forms. Comparison between the Zadokite Document and the Manual substantiates the later dating of the Manual. In the Zadokite Document are to be found different names, organization, classes of people, and practices from those in the Manual. The Manual shows development beyond the Zadokite Document in the covenant ceremony, in discipline, in economic structure, in its attitudes towards the Temple, sacrifice, fellowship, and study of the Torah. The commentaries and the Hymns are related more to the Zadokite Document than to the Manual. The War Scroll seems to be the most peculiar scroll of all and though it is similar in certain ways to the Rule could have originated outside the community. The Rule is a Qumran document with distinct characteristics of its own also, and could be dated before the Manual but after the Zadokite Document.

To describe the community one must recognize that certain changes naturally occurred in the organization, aims, and attitudes of the community. The society is rightly described as priestly, militaristic, eschatological, pietistic, and sectarian. It was a priestly and pietistic group throughout its history, although its attitudes towards the Temple and scrifices became more spiritualized with time, so that the community came to conceive of itself as the true Temple and as an atonement for Israel through its own special piety. The group was less militaristic, sectarian, and perhaps less eschatological also, in the later stages of its history.

Microfilm $3.60; Xerox $12.20. 278 pages.

TYPES OF AMERICAN LIBERALISM, 1900-1935

(L. C. Card No. Mic 59-4102)

Wilfred Kenneth Cauthen, Ph.D.
Vanderbilt University, 1959

Supervisor: Professor Roger L. Shinn

During the years 1900-1935 theological liberalism reached the height of its power and influence in America.

The liberal theology which flourished during this span of thirty-five years constitutes the subject matter of this dissertation. An investigation has been made of the thought of a number of representative liberal theologians in order to discover the presuppositions, the methods, the structure, and the content of liberal theology. Specifically, the aim is to set forth the major types of liberalism and to show how these types differ from each other within the general liberal framework. The inquiry, then, is an attempt to discover the essence of American theological liberalism and to describe the most important concrete forms in which this essence appears.

The study reveals that liberalism arose as an attempt to harmonize the historic Christian faith with modern ways of thinking. Three fundamental principles derived from modern culture became the determinative factors in the minds of liberal thinkers and provided the framework in terms of which Protestant orthodoxy was reinterpreted. These are the principles of continuity, subjectivism, and dynamism. The first emphasizes unity and likeness in the world, particularly between nature, man, and God. The second stresses the role of reason and experience in attaining religious knowledge. The third focuses upon the importance of growth, development, and process in nature, in history, and in human life and thought. The effect of these principles is seen most readily in the stress upon the immanence of God, the authority of religious experience, and the doctrine of social progress.

Within the general liberal framework several types of liberalism may be discerned. The basic division is between the evangelical liberals, who took the revelation of God in Christ to be normative and attempted to reinterpret this abiding truth in modern categories, and the modernistic liberals, who were fundamentally determined in their thinking by modern culture but believed that the essence of historic Christianity was compatible with their findings. Within each of these groups a further distinction can be made between the ethical-social thinkers, who were primarily interested in religion as a practical solution to the moral, social, and spiritual needs of men, and the metaphysical or empirical thinkers, who combined a practical interest in religion with an attempt to incorporate Christian theology into some philosophical world-view.

Eight men have been chosen as typical representatives of these various types of liberalism. The evangelical liberals are William Adams Brown, Harry Emerson Fosdick, and Walter Rauschenbusch as ethical-social thinkers and A. C. Knudson and Eugene Lyman as metaphysical thinkers. The modernistic liberals are Shailer Mathews representing ethical-social modernism and D. C. Macintosh and Henry Nelson Wieman representing empirical modernism.

The thought of each of these men has been examined with reference to five leading theological issues: general orientation and methodology, God, man, Christ, and the church. Speaking very broadly, the center of liberalism is its stress on the way in which an immanent God, Christlike in nature, has been at work over the long ages to produce an ordered cosmos and to perfect a creature made in the divine image who will co-operate with him in the establishment of a world-wide kingdom of love and brotherhood. Christ is viewed as the divine man who reveals the nature of God and aids man in overcoming the hindrances of nature to his weak but advancing spirit.

The writer concludes that while liberalism has made great contributions to theology, it is beset with fundamental weaknesses which made it inadequate for contemporary needs without a thoroughgoing reconstruction of some of its basic motifs.

Microfilm $8.05; Xerox $27.60. 636 pages.

THE ATTITUDE TOWARD THE STATE IN THE NEW TESTAMENT

(L. C. Card No. Mic 59-4106)

Clyde Willis Cutrer, Ph.D.
Vanderbilt University, 1959

Supervisors: Professor Lou Silberman and
Professor Kendrick Grobel

What is the attitude toward the State in the New Testament, or if there is more than one attitude, what are the attitudes toward the State? This, in brief, is the question examined in this study. The word "State" is used to designate the foreign overlord, or more specifically, the Romans, rather than the State in general.

The investigation is made in four areas of the New Testament to determine whether the attitude is consistent. These areas are: (1) the Synoptics and Acts, (2) the Pauline Materials, (3) the Post-Pauline Materials, and (4) the Johannine Materials. The relationship of these sections is primary. Thus, the inquiry may be stated in these words: does the same sweeping attitude characterize each of these areas, or does it vary depending upon the materials in question?

The following passages make up the basic field of investigation: Mark 12:13-17 (Matthew 22:15-22, Luke 20: 20-26), Romans 13:1-7, I Peter 2:13-14, Titus 3:1, I Timothy 2:1-2, and Revelation 13. Moreover, it is recognized that each passage arose out of a particular background, and that the attitude toward the State in each instance can best be determined by placing the passage against its most probable life-setting. This is the general approach employed.

It is found that the attitude in Revelation is an attitude of State-denial, but as this attitude is placed side by side with the attitude in the Synoptics and Acts, it is clear that there is no complete harmony in these sections as far as the State is concerned. Far from advocating an attitude of State-denial, Jesus rather incidentally accepted the State and recommended paying taxes to Caesar, while emphasizing most of all that men owe primary allegiance to God.

Moreover, when the attitude of John is cast against the background of the Luke-Acts approach, again one is impressed with the difference in the two. In Luke-Acts there is evidence which indicates that the author subtly affirms the State by showing the "political inoffensiveness" of Christianity. He actively seeks out the toleration of the State.

Further, as the attitude of John is compared with that of Paul, it becomes clear that Paul stands even further away from the attitude of Revelation than does the author of Luke-Acts. Paul has not subtly affirmed the State. He has boldly and highly praised it as having been ordained by God Himself.

Still further, one looks in vain in Revelation for the counsel of I Peter and Titus to be loyal to the State. One

finds missing the advice of I Timothy to make intercession for the government. One does find a hatred of the State and a fiery denunciation which is not found in the Post-Pauline materials.

There is, then, no single New Testament attitude toward the State. There are a variety of attitudes, each arising out of the interplay of Church and State, even as the interpretations of the New Testament attitudes are themselves reflections, in many instances, of the interplay of Church and State during the period of the writers making the interpretations. As conditions of the State are not static, neither are the attitudes toward the State static, since they arise in response to existing conditions. It remains true that the Christian's primary allegiance is always to God, but outside of this fundamental affirmation, there exist various "Christian" responses to the State. It may be simpler and more comforting to do as Oscar Cullmann has done and reduce these attitudes down to a vague general attitude, but it is not in keeping with the evidence.

Microfilm $2.20; Xerox $7.60. 165 pages.

A COMPARISON OF CONCEPTS OF THE STATE IN ROMAN CATHOLICISM AND THE ECUMENICAL MOVEMENT

(L. C. Card No. Mic 59-3457)

Richard Donald Nye Dickinson, Jr., Ph.D.
Boston University Graduate School, 1959

Major Professor: Dr. Walter G. Muelder

This study attempts a systematic survey and comparison of Roman Catholic and Ecumenical Movement (since 1925) doctrines of the state conceived as a universal institution and the political instrument of society. It deals with the theoretical doctrines of each group, and not with either the historical evolution of these concepts, or with the actual practices of these groups in their relations with particular states. Strictly speaking, it is not a comparison of Roman Catholic and Protestant views of the state because the Movement embraces some non-Protestants.

A systematic classification of both theoretical and functional aspects of the state's life has been developed, including such subjects as the state's "nature," "purpose," "authority," "relation to the individual," etc. Using this classification as a structural frame, the Roman Catholic and Ecumenical doctrines of the state are presented individually, and then the two positions are compared.

For the definition of the Roman Catholic position the study relies on papal encyclicals (primarily in the last 100 years) and works bearing the Imprimatur of the Roman Church. Occasional works by prominent Roman Catholic political theorists which do not carry the Imprimatur are also referred to. The Ecumenical position is gleaned primarily from the reports of the Movement, especially from the Stockholm, Oxford, Amsterdam and Evanston statements. Buttressing these statements are innumerable working papers and mimeographed reports, often the work of individuals, and sometimes of study groups, in conjunction with the Movement. Selections from these writings, and the organization of them under the classification used in this study, are made on the basis of a logical coherence theory, as proposed by such philosophers as Edgar Brightman.

In addition to a systematic articulation of Roman Catholic and Ecumenical doctrines of the state, this comparative study leads to the following conclusions. (1) Great diversity exists, particularly on the theoretical level, between various elements within both the Roman Catholic and Ecumenical groups. (2) There are broad affinities and important differences between Roman Catholic and Ecumenical doctrines of the state. Many significant differences are delineated not so much by a distinction between Ecumenical and Roman groups as one between Protestant and Catholic elements. (3) Ecumenical thought has generally either ignored or repudiated metaphysical structurings in its doctrine of the state, even though many members deplore this attitude. Focus on the responsible society provides an operational via media between these groups. Conversely, the Roman Catholic doctrine of the state is usually defined in relation to a general metaphysical system. (4) The tenor of Roman Catholic thinking is substantialist, while Ecumenical thought is permeated with a functional spirit, reflecting Protestantism's existentialist mood. (5) Both Roman Catholic and Ecumenical conceptions of the state show agile responsiveness to pragmatic needs and conditions. The concepts of the "common good" and the "responsible society," central in Roman Catholic and Ecumenical positions respectively, provide the focus through which pragmatic conditions have tremendous impact on doctrines of the state. (6) Most differences between Roman Catholic and Ecumenical concepts of the state exist on the theoretical level; there is extensive similarity between the two perspectives on the operational and functional level. (7) In both Roman Catholic and Ecumenical documents there is considerable ambiguity about the doctrines of the state, resulting largely from efforts to be both normative and relevant. (8) Although differences persist, there are significant areas of rapprochement between Roman Catholic and Ecumenical thought about the state. (9) Several lesser conclusions may be found in the comparative section of the dissertation.

Microfilm $7.95; Xerox $27.20. 628 pages.

REVERENCE FOR LIFE IN THE CAREER OF ALBERT SCHWEITZER

(L. C. Card No. Mic 59-3458)

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Boston University Graduate School, 1959

Major Professor: Professor Paul Emanuel Johnson

The purpose of this dissertation is to learn what "Reverence for Life" means in the career of Albert Schweitzer. What motivated Schweitzer at the age of thirty to renounce promising, if not brilliant careers in music, theology and philosophy to begin the study of medicine to become a medical missionary in Africa?

In his fortieth year the phrase "Reverence for Life" came to him as the unifying principle to explain the surge of life and his religious response in ethical responsibility.

Schweitzer maintains that the ethic of "Reverence for

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Life" comprehends within itself everything that can be described as love, devotion and sympathy whether in suffering, joy or effort. Resignation of self enables man to grasp the elemental oneness of life. Life-affirmation is a spiritual act whereby man ceases to live unreflectively and comes to devote himself to all life with reverence. Schweitzer's concept of Reverence for Life is really the ethic of Jesus brought to philosophical expression, extended into cosmological form, and conceived of as intellectually necessary.

Reverence for Life does not allow him to appropriate his own happiness. Out of conflictual struggle Schweitzer has faced renunciation of music, academic activities, and financial independence.

Total renunciation has not been required.

Controversial issues which critics of Schweitzer debate are: (1) Schweitzer's view of Jesus; (2) the apparent pantheistic nature of life; (3) a conflictual Weltanschauung; (4) the apparent duality of his life and thought.

The culmination of the struggle is resolved in Schweitzer himself who continues to carry heavy responsibilities. This integration of conflictual struggle within his life and the eventual resolution that emerges give the key to the greatness of his life, for within his own will-to-live is the will-to-love which expresses Reverence for Life.

The procedure of this dissertation follows psychological and historical methods of research. Primary data have been gathered to see what part relationships, behavior, and attitudes play in a dynamic study of conflictual interests.

This study has been interested in the motives that have urged Schweitzer on to goals of fulfillment, and how conflicts have been resolved, sublimated, and integrated with insight and productive achievement.

Summarized, the conclusions are as follows:

(1) Reverence has been a growing concern of Albert Schweitzer, from early childhood through unfolding experiences and discoveries.

(2) Schweitzer went to Africa not for flight from academic responsibilities nor the desire for isolation from civilization but rather to obey the injunction of Jesus: "Whosoever would save his life shall lose it, and whosoever shall lose his life for My sake and the Gospel's shall save it."

(3) Goethe's influence on Schweitzer has been more profound than that of any other person with the exception of Jesus, for to Goethe does he owe not only the phrase "Reverence for Life" but also his ethical naturalism.

(4) The culmination of the conflictual struggle has taken place in each epoch of his life through renunciation and intense devotion to the needs of living creatures.

(5) Renunciation has not been demanded of him in the fields he was prepared to renounce: academic activities, music, and financial independence.

(6) The multiplicity of his vocational pursuits has challenged Schweitzer to seek a more profound reconciliation.

(7) Although medicine has been the means by which Schweitzer felt he could serve suffering humanity best, his writing on scientific medical findings has been almost nonexistent.

(8) Schweitzer's lifelong ability to set goals of achievement for growth has made for an integrity of purpose in his life and writings.

(9) Schweitzer's awareness of elemental unity in diversity has come to a fundamental resolution through Reverence for Life as Christ-mysticism, an ethic of world- and life-affirmation.

Microfilm $4.00; Xerox $13.40. 310 pages.

JOHN OF RUYSBROECK: HIS MYSTICISM AND INFLUENCE UPON GERHARDT GROOTE AND JOHN TAULER

(L. C. Card No. Mic 59-3460)

Donald Hubbard Freeman, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Edwin P. Booth

The life and writings of the Blessed John of Ruysbroeck lie at the heart of the Golden Age of Mysticism. The purpose of this study has been to present his life and an interpretation of his writings in the form of a narrative poem cast in English Heroic Verse, thoroughly documented according to accepted dissertation practice, and to show that his life and writings exerted influence upon Gerhardt Groote and John Tauler.

The result of the study indicates that Ruysbroeck had a clear conception and structure of his mystical thought, presenting a doctrine of God: Father, Son, and Holy Spirit; a doctrine of man; and a conception of the Church, which, while illuminated in many instances with mystic insight, are still conformable to the spirit and intellect of the fourteenth century.

His way of resolving the Eternal Paradox of Rest and Work captured the imaginations of Groote and Tauler. Groote, working through the Brethren of the Common Life and infusing the Devotio Moderna with Ruysbroeck's thought through the Brother houses of the Low countries, exemplified the work concept as he had learned it under the Augustinian Canon regula at Groenendael. Tauler captured Ruysbroeck's concept of union with God as expressed in The Adornment of the Spiritual Marriage and The Sparkling Stone, and translated that concept from speculation into action as his sermons fired the people who came to hear him.

Thus, through the educational methods of the Brethren and the preaching zeal of the Friends, the concepts of Ruysbroeck gained the attention of the people of the fifteenth and sixteenth centuries, contributing to the groundswell which eventuated in the Reformations.

Justification of the use of poetry in this study may be found in the fact that much of Ruysbroeck's writing was originally cast in a verse structure which is not unpleasing, although the poems were never accepted by students of literature for their literary quality.

> The whole of Christian mysticism lies
> In love identifying mind and soul
> With God, and sharing sacrifice with Christ.

This definition of Christian Mysticism, drawn from the writings of Ruysbroeck, and cast into poetic form, indicates the structure of the entire study, a merging of mind and spirit. The mind studying to learn, and the spirit eager to communicate.

> A debt to pay: to love the love that loves,
> And yet, once paid, is ever reincurred.

This thought, expressed in poetry, summarizes over a page of Ruysbroeck's prose in The Seven Steps of the Ladder of Spiritual Love without doing an injustice to the passage.

> .....One unbegotten
> Nor begetting; but pouring forth from God

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The Father and the Son as their own breath,
He moves the soul to seek Him seeking it.

This description of the function of the Holy Spirit actually compresses almost an entire chapter of The Adornment of the Spiritual Marriage. These excerpts illustrate the manner and style of communication.

Included in the study is a complete biographical sketch of John of Ruysbroeck and briefer summaries of Groote and Tauler. The study concludes with the vision that

.....The time will come
When words will prove no barriers, and we
Shall nothing be, except in Him whose love
The mystic tries to gain. Words will fail, they must;
But love will never fail, for God is love.

Microfilm $2.00; Xerox $5.80. 119 pages.

LAY LEADERSHIP FOR URBAN PROTESTANTISM: A STUDY OF LAY LEADERSHIP AND LAY LEADERSHIP TRAINING FOR PROTESTANT CHURCHES IN THE INNER CITY AREAS OF NEW YORK CITY

(L. C. Card No. Mic 59-1936)

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New York University, 1959

Problem: To determine the functions of lay leaders and the types of lay leadership training needed in the Christian education program of Protestant churches within the inner city areas of New York City in relation to the social needs characteristic of these communities.

Procedure: To determine the characteristics and needs of the inner city areas of New York City, a study was made of the basic texts in the field of Urban Sociology, studies of urban communities, and personal study of the data from the 1950 U. S. Census and other sources concerning the thirteen inner city communities of New York City selected on the basis of the determined inner city characteristics.

To determine the role played by Protestant churches in urban community life, a study was made of the literature concerning the relation of the church to society and the Sociology of Religion including significant research studies of the problem. In addition, based on membership figures of churches found to be located in the inner city, two churches from each inner city community were selected at random, and data collected from ministers and laymen on the role of the church using an interview schedule.

To determine the use and function of lay leaders in Christian education in these churches, information was obtained through group and individual interviews. Information on the leadership education given to the leaders was also obtained.

To determine the types of lay leadership training usable by the inner city church, characteristics and methods were collated from the literature in adult and leadership education as well as religious education. Similar information was requested through correspondence and interviews from leadership education executives of the churches; these were listed as criteria for evaluating types of training used in the churches and suggested by the literature. This data was also used for the establishment of principles for the development of lay leadership training programs for the inner city churches.

Findings and Conclusions: (1) Urban ecological studies point out the inner city as the location of communities which are the focus of social pathology. (2) The churches in these communities either decide to serve the community or leave the community; those remaining demonstrate various levels of adaptability to the community needs. (3) On the basis of a random sampling, it was seen that no unique approaches to the community were being undertaken by the churches nor were significant leadership training programs being developed. (4) The informal methods available for training laymen were found to be adaptable to the requirements of these churches when used jointly with procedures of the group dynamicists as recently adapted by leading denominations. (5) Programs being devised fail to consider the unique social problems of the inner city. (6) Overuse has been made of lecture-discussion methods and their variants. (7) The literature and, to a limited degree, the recommendations of the religious leadership education executives provide a basis for formulating principles for developing training programs for inner city church laymen which will apply adequate adult education methods and consider the social milieu of the learners. (8) An adequate program of supervision for lay leaders in these areas cannot be determined on the basis of the data collected in order to establish a relationship between trained supervisory personnel and the membership of the church and/or the leadership. To be able to establish some desirable ratio would necessitate a study of qualitative factors operating within the dynamics of the relationships between clergy and laity.

The study concludes with an attempt to formulate a training program for use by the inner city churches based on the principles established.

Microfilm $6.75; Xerox $23.20. 529 pages.

IMAGES OF MAN IN FIVE AMERICAN DRAMATISTS: A THEOLOGICAL CRITIQUE

(L. C. Card No. Mic 59-4110)

Woodrow Augustus Geier, Ph.D.
Vanderbilt University, 1959

Supervisor: Professor Roger L. Shinn

Basing its conclusions upon an analysis of the published plays of Eugene O'Neill, Paul Green, Maxwell Anderson, Tennessee Williams, and Arthur Miller, this thesis shows how various images of man are presented in individual plays and in the works of the dramatists as a whole.

Chapter I shows the relationships between the roles of theology and drama and establishes the relevance of theology as a broad coordinating principle for dramatic criticism, making it possible for the critic to form "proximate judgments" upon works of art by uncovering the premises that underly these works.

Chapter II shows how theology and drama impinge upon each other through their interpretation of themes that apply to the doctrine of man. In the way these themes are treated,

the theological critic sees certain images of man. Four images are defined for the study: (1) Liberal Man (the rationalistic image); (2) Natural Man (the romantic image); (3) Imperfect Man (an image that has affinities with the Christian view), and (4) the Materialistic Image. In these images, the study sees reflections of ancient and modern body-soul dualisms traceable to a view of man termed the "anthropological heresy." The four images of man and various elements of the "anthropological heresy" are examined in the light of the Christian understanding of man, which is symbolized by the concept of the Imago Dei, a concept that relates to every aspect of man's being.

Five chapters on the five respective dramatists show how man is seen as a unique creature who searches for identity, belonging, and salvation, who is subject to finitude and death, who is transcendent over the natural world, and who is a being creative, responsible, sinful, and guilty. These chapters, summarized in Chapter VIII, show that the drama of the study signals the passing of Liberal Man. They show that Natural Man is a "minor note" in the dramatics. The materialistic image of man is unanimously rejected. The prevailing image is Imperfect Man. The "anthropological heresy" in the drama is a significant barrier to the Christian understanding of man. It is a limiting factor for both dramatic art and criticism. The drama contains a "secular witness" to the Imago Dei in man. Its points of affinity with biblical faith in the understanding of man are noted as "biblical" or "New Testament translation."

The study sees, in the way in which the dramatists handle themes that relate to the doctrine of man, a report of modern man's questions and yearnings which are fulfilled in the Christian doctrine of Incarnation-Resurrection. This doctrine preserves man's uniqueness and guards his individuality and wholeness against all impersonal and "world-denying" views that would destroy him.

Microfilm $4.50; Xerox $15.00. 350 pages.

THE PRIESTS OF QUMRAN

(L. C. Card No. Mic 59-4113)

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Supervisor: Professor J. Philip Hyatt

The Dead Sea Scrolls contain numerous and frequent references to priests and to matters sacerdotal. This has given rise to the suspicion that priests played a major role in the life of the community which produced and/or preserved the scrolls.

Specifically, what was the status of the priests in the Qumran community and how did they function within its structure? What part did they play in its initial organization? What were their relations with the world at large and especially with the overall Jewish priesthood? What cultic functions, if any, did the priests carry on at the Qumran center? Did the priests play a part in the community's understanding of its raison d'être? May the organization of the Qumran priests and their lay cohorts be safely identified with any previously known Jewish sectarian group?

Archaeological investigation has fixed the limits of permanent occupation at the Qumran site by the sectarian community between a time during the reign of John Hyrcanus (134-104 B.C.) and the First Jewish Revolt (67-72 A.D.). In order to allow for the foundation and development of the group prior to the construction of permanent facilities, the boundaries of this investigation may be placed at 200 B.C. and 70 A.D.

The present inquiry began with an analysis of the available published material from Qumran. Special attention was given the "governmental" documents (1QS, 1QSa and CD) and the pesharim. The picture thus achieved was enlarged by consulting other works which bear traditions from the same general period. These include the Apocrypha and Psuedepigrapha, the Rabbinic literature, the works of Philo and Josephus, and the New Testament. The extensive secondary literature on the Dead Sea Scrolls and related subjects added depth and detail to the picture.

It was found that the priests in the Qumran community possessed both power and prestige in generous measure. They were the primary custodians of the covenant and the primary authorities on Torah. They occupied first place in all community affairs. They were expected to hold a similar position in the nation at large when the right order was restored in Israel.

There are indications that the sect itself arose from a pietistic priestly schism which attracted lay adherents. A priest who bore the title mwrh hṣdq was considered to be the orienter, if not the founder, of the group.

An attitude of general hostility was directed toward all outsiders. A "Wicked Priest" was among the sect's special foes. They considered the Jerusalem priests their enemies.

The sect denied the licity of the Temple priests because of numerous sins. The validity of the Temple priesthood, however, was not necessarily put in jeopardy. Certain other contemporary sources share the sect's low view of the Temple priests.

The sect upheld the validity and licity of its own priests. It is possible that a superior pedigree was claimed for the Qumran priests.

The priests continued to exercise all of the traditional functions of the Jewish priesthood at Qumran except those which were prevented by separation from the one legitimate Temple. The necessity of these priestly acts to the fulfillment of Torah made the priests essential to the community's existence as a paradigm of true Israel.

It seems impossible at the present stage of investigation to identify the Qumran group with any previously known Jewish sect. They may represent a previously unknown group. For this reason, the title "the Covenanters," or some other non-prejudicial term, is used throughout the study. Microfilm $2.90; Xerox $10.00. 221 pages.

A CRITICAL EXAMINATION OF THE TEXT OF ISAIAH BASED ON THE DEAD SEA SCROLL OF ISAIAH (DSIa), THE MASORETIC TEXT, THE SEPTUAGINT AND THE ISAIAH TEXTS OF CLEMENT OF ALEXANDRIA, ORIGEN, AND EUSEBIUS

(L. C. Card No. Mic 59-3466)

Forrest Donald James, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor David K. W. Kim

The problem of this dissertation is to compare the text of the Dead Sea Scroll of Isaiah (DSIa) with the Masoretic text, the Septuagint, and the Isaiah texts of the early church fathers, Clement of Alexandria, Origen, Eusebius, Justin Martyr and Ignatius, and from this comparison to determine the best possible readings for the particular variants studied, and also to determine the textual value of DSIa in reconstructing the most probable original text of the book of Isaiah. A necessary part of this comparison has been the inclusion of the conjectures of many textual scholars on the book of Isaiah and other textual witnesses.

The methodology of the dissertation included research in five areas: (1) collecting of the quotations from the book of Isaiah as used by the church fathers mentioned above; (2) study of the textual variants between DSIa and the Masoretic text and a selecting of those variants which seemed to afford a definite change in the meaning of the verse; (3) study of available textual witnesses for each variant, including the Septuagint, DSIb, the Isaiah quotations found in the New Testament and other Dead Sea manuscripts, etc.; (4) examination of the outstanding textual studies of the book of Isaiah; (5) study of pertinent books and periodical articles dealing with the Dead Sea Scrolls. From the results of this research, textual comparisons were made of the DSIa variants and the textual witnesses in light of the previous textual studies of the book of Isaiah.

Chapter II of the dissertation is an account of the discovery of the Dead Sea Scrolls of Isaiah. After this discovery in 1947, a sense of the significance of these scrolls began to sweep the world of Biblical scholarship. The controversy concerning their antiquity and dating raged over the next few years, but the consensus among scholars is that these scrolls date from the second or first century B.C., in the main, and thus afford, in addition to other materials, texts in Hebrew of Isaiah which are approximately one thousand years older than the Masoretic text.

The discovery of the scrolls led then to the re-discovery and subsequent excavations of Khirbet-Qumran and the linking of these scrolls and this community with the ancient sect of the Essenes. This identification of the Qumran community with the Essenes is another of the scholarly controversies that has been the subject of much writing in the past decade, but concerning which there is a growing consensus in favor of the identification.

Both DSIa and DSIb in effect are in agreement with the Masoretic text, though DSIa shows more differences of spelling, pronunciation, etc., than does DSIb. In general, however, they afford striking witness to the accuracy of the transmission of the Masoretic text.

Chapter III is a study of one hundred sixty-seven variants between DSIa and the Masoretic text. For each variant, the present author has drawn his conclusions as to the superior reading, in light of the readings of the textual witnesses mentioned above, and the scholarly studies consulted.

Chapter IV comprises four sample chapters (26, 51, 52, 60) of the Hebrew text of Isaiah and the author's translation in light of the studies made in Chapter III.

The conclusions drawn from this research fall into two categories: (1) specific conclusions about each variant studied in Chapter III; (2) general conclusions as to the value of DSIa in reconstructing the most probable original text of Isaiah. Of the one hundred sixty-seven variants studied, the author concluded that in forty-five instances DSIa offered superior readings. These are important emendations for in most instances the Masoretic text was obviously corrupt.

Microfilm $5.60; Xerox $19.60. 439 pages.

THE NEW TESTAMENT CONCEPT OF CONSCIENCE

(L. C. Card No. Mic 59-4115)

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Vanderbilt University, 1959

Supervisor: Professor Kendrick Grobel

Syneidēsis was derived from the verb synoida, a compound of oida. Oida connoted immediate knowing as an eye-witness. The prefix syn- first indicated knowing with another person, then knowing with oneself, i.e., being conscious or aware, of ethically relevant conduct or of facts not thought to have ethical import. In its earliest appearances (Democritus and Chrysippus) syneidēsis meant knowledge or consciousness. In the Hellenistic period syneidēsis was used for ethical consciousness or the conscience (Philo, Plutarch, Dionysius of Halicarnassus, et al.) Its primitive meaning (knowledge or awareness was never abandoned.

The Hellenistic concept of conscience was that of an inner watcher who knows, judges, and witnesses to the deeds of a man--usually his own previous evil deeds. Occasionally the syneidēsis judged the deeds of other persons, or had future reference, or witnessed to good deeds. Conscience was usually related to God in pantheistic terms.

There is some evidence that Stoics and Epicureans used syneidēsis, but not as a technical philosophical term. Syneidēsis seems to have originated and had its habitat in the common speech, which was the source of the term for the New Testament writers. The New Testament use of syneidēsis cannot be comprehended, however, solely in terms of its origin.

Syneidēsis is used in LXX Ecclesiastes 10:20 (for māda^{c}), where it means the inner life or consciousness. Manuscripts S and C of LXX Ecclestiasticus 42:18 read syneidēsis. Here it stands for no Hebrew equivalent and connotes knowledge. Syneidēsis is used for conscience in Wisdom of Solomon 17:10 and in Testament of Reuben 4:3. Technically, therefore, syneidēsis is part of the LXX influence upon St. Paul's vocabulary, although the importance of this influence is debatable.

Although there is no specific word for conscience in the

Hebrew Old Testament, the fact of conscience is clearly portrayed; and several words, especially lēbh (kardia in LXX), were used to express aspects of conscience. The Greek Old Testament clearly seems to have colored the New Testament concept of conscience. The New Testament concept of conscience is a blend of Greek and Jewish ideas.

The New Testament concept of conscience began with the common Greek concept. The basic aspect of awareness is present either implicitly or explicitly in all New Testament occurrences of syneidēsis. The conscience is portrayed as judge and witness. But the New Testament concept goes beyond the secular Greek notion to produce what may properly be called a Christian concept of the conscience.

St. Paul conceived of the conscience as a definite human faculty (I Cor. 8) which can judge the deeds of oneself and of other persons (I Cor. 10:28f; II Cor. 4:2; 5:11) and has future reference (I Cor. 8; 10:25; 27; Rom. 13:5). In some passages his use of syneidēsis carries the sense of moral conviction (I Cor. 10:25, 27, 29; Rom. 9:1; 13:5).

The post-Pauline writings continue these advances and expand the concept of conscience. The dependence of the Faith on a good conscience is noteworthy (I Tim. 1:5, 19; 3:9). The good conscience is also the impetus to do good (especially Acts 23:1; 24:16; II Tim. 1:3; Ignatius Smyrna. 11:1). Syneidēsis has a social aspect, especially in the Apostolic Fathers. The conscience is called evil or corrupt in Titus 1:15; Heb. 10:22; Hermas Mandates 3:4).

The relationship between conscience and God is made definite; a good conscience comes from God or enables effective prayer (I Peter 3:21; II Clement 16:4; Didache 4:14), and the good conscience depends on Christ's sacrifice (Heb. 9:9, 14; 10:2, 22).

The distinguishing features of the Christian concept of conscience are (1) that it is an abiding faculty, (2) that it can refer to the future by judging proposed conduct, (3) that the Faith depends upon it, and (4) that it depends upon our Lord's sacrifice.

Microfilm $2.85; Xerox $9.80. 217 pages.

LUKE AS A HISTORIAN IN CRITICISM SINCE 1840

(L. C. Card No. Mic 59-4116)

Andrew Jacob Mattill, Jr., Ph.D.
Vanderbilt University, 1959

Supervisor: Professor William Kendrick Grobel

This study has attempted to isolate the basic threads running through that body of relevant critical material which deals with the reliability of Luke as a historian. It is contended that a critic's attitude toward Luke as a historian in general, and toward his trustworthiness in particular, depends upon four factors: his (the critic's) conception of the Petrine-Pauline relationship; his attitude toward miracles; his view of ancient and modern historiography; and his use of antiquities.

The principal problem in assessing the historicity of Acts is the Petrine-Pauline relationship. If, in the opinion of the critic, Luke is right in representing this relationship as one of basic unity, or, if the critic holds that the harmonious view of Acts is one-sided (under the influence of a tendency or other factors), but correct within the limits of his purpose, then he will rate Luke highly as a historian. But if the critic believes that Luke has misunderstood or misrepresented as peaceful a relationship that was basically antagonistic, then he will be very skeptical of the trustworthiness of Acts.

Those critics who affirm that the miracles in Acts are possible and credible, or at least that allowance must be made for ancient man's belief in miracles, will find the miraculous element in Acts no real stumbling-block in the way of Luke's credibility. Those who hold that miracles are impossible, or at least that those recorded in Acts are incredible, will be led to deprecate the reliability of Acts.

To a considerable degree, a critic's evaluation of Luke's work will depend upon the demands he makes of Luke in respect to historical method. If he expects too much of Luke, he will undervalue him; if he expects too little, he will overvalue him.

A critic's rating of Luke is also influenced by the amount of support to the accounts in Acts he finds in archaeological, topological, numismatical, and literary antiquities.

The critic who wishes to make a sound evaluation of Luke as a historian cannot evade any one of these four key problems. The extent to which he correctly comprehends these issues is the extent to which he correctly judges Luke's value as a historian. The extent to which he misconceives, slights or ignores these problems is the extent to which he misevaluates Luke's worth as a historian. A critic's view can be appraised on the basis of how well he has dealt with all the relevant facts.

This four-stranded thread, which makes possible the most effective analysis of the historical character of Acts, is traced through important works since 1840. Then, against the background of over a century of research, the current conceptions of these issues are presented. Many problems remain unsolved, perhaps unsolvable, and numerous "ghosts" refuse to be laid. In short, the basic questions are taken up as problems and left as problems.

But such a method has made possible an advance beyond the sub judice issues of date and authorship to more fruitful questions which must be raised irrespective of date and authorship. It has resulted in the organization of the literature around the four strands so as to reduce the bulk of the material to manageable dimensions. It has presented many problems, much data, and some solutions. It has shown that there are certain errors of method to avoid as well as certain maxims to follow. It has facilitated the presentation of those theological, philosophical, and methodological presuppositions which affect a critic's attitude toward the four key issues. It has necessitated the compilation of an extensive bibliography. Finally, it has demonstrated that no simple judgment can be made upon the historical value of Acts.

The hindsight thus gained into the criticism of the past should increase insight into the problems of the present and provide some foresight into the paths of future inquiry. Much remains to be done in the study of Luke as a historian. It is the writer's conclusion, however, that sober scholarship will always regard Luke as the type of historian who wrote for truth and for the good of mankind.

Microfilm $8.10; Xerox $27.60. 639 pages.

A HISTORY OF THE REGULAR BAPTISTS IN RHODE ISLAND, 1825-1931

(L. C. Card No. Mic 59-3474)

Charles Allyn Russell, Ph.D.
Boston University Graduate School, 1959

Major Professor: Dr. Richard M. Cameron

The story of Baptist beginnings in Rhode Island through Roger Williams and John Clarke is a familiar one. The writer of this dissertation, while reviewing the early and familiar chapter of Baptist beginnings in America, concentrates upon the more recent and neglected period from 1825 to 1931. The result of the research is the first state history of Rhode Island Baptists.

The principal primary sources for this study have been the annual minutes of the Rhode Island Baptist State Convention; the yearbooks of the Warren, Providence, Narragansett, and Roger Williams associations; and the minutes of seven representative Baptist churches. State, city, and town histories have also been consulted as well as Rhode Island newspapers and contemporary Baptist magazines and journals.

Secondary sources have included the main denominational histories and standard surveys and monographs in the field of the American church. Throughout the dissertation the author has constantly attempted to relate the Baptist history of this one particular state to the larger national religious framework of which it has been a part.

The conclusions drawn from the study are as follows: (1) The position of the Baptists as the strongest Protestant denomination in Rhode Island was not basically the result of priority in the state, but the consequence of diligent and persistent home missionary endeavors, more enthusiastic than that carried on by other denominations. (2) The Baptist churches of Rhode Island from 1825 to 1931 were distinctive for the extent of their voluntary cooperation with the state convention. When the convention was formed in 1825 there were eight constituent congregations. Within fifteen years every "regular" Baptist church in the state was identified with this larger fellowship. This is an example of cooperation and mutual endeavor unequaled by the Baptist churches of other states. Several factors account for the early and united nature of this fellowship. In a small state the opportunities for cooperation were greater than in a territory where congregations were separated by vast geographical distances. Secondly, the convention which was responsible for the founding of many churches, naturally linked them to state leadership from the time of their beginnings. Thirdly, the relative uniform theological pattern of most of the churches encouraged a united rather than a divided witness. Fourthly, the challenges created by the dominant Roman Catholic population had a tendency to draw the churches together against what was interpreted to be a common foe. (3) Rhode Island Baptists are to be remembered for the extent of their social concern as seen in the activities of the convention; in the life of the leading Baptist of the period, Francis Wayland, who introduced the elective system of studies at Brown University; and in the most prominent congregation of the state, Calvary church of Providence, which introduced an institutional program during the years from 1898 to 1917. (4) Rhode Island Baptists were characterized by a number of leaders in the educational and pastoral fields whose religious and social influence extended beyond the state in which they served. The most noted of these, Francis Wayland, was progressive in educational approach but conservative in religious conviction. (5) Rhode Island Baptists had a share in creating the social and religious influence of a growing America. The emphasis of Rhode Island Baptists upon conversion and Christian growth and their willingness to champion progressive social movements did much to make a Christian impact in moulding the ideals of the state and, indirectly, the nation. Based upon the conclusions reached, it is the conviction of the author that the Baptists of Rhode Island from 1825 to 1931 justified their existence.

Microfilm $5.10; Xerox $17.00. 399 pages.

TOWARD A REDISCOVERY OF THE NATURAL IN LUTHERAN THEOLOGY

(L. C. Card No. Mic 59-3818)

Karl Theodore Schmidt, Ph.D.
State University of Iowa, 1959

Chairman: James C. Spalding

It is the initial claim of this dissertation that Lutheranism in America has lost the concept of the "natural." This is to say that it has lost its appreciation for those drives, loves, and talents in man which belong to the "given" with creation and, even after the Fall, operate toward "health" and self-realization within a limited area.

Lutheranism has not gone over to the ultra-liberal view which in its optimism concerning human nature does not clearly distinguish between the "natural" and the "unnatural." By the latter we mean the demonic and destructive operating in the human situation. Lutheranism insists on the need of divine grace, but it has largely fallen prey to the view that comes dangerously close to identifying the "natural" with the "unnatural," i.e., the sinner with his sin. This makes for a serious disparagement of man and destroys the full Anknuepfungspunkt for the grace of God in its operation in man.

The dissertation goes on to show that it has not always been so in Lutheranism. Both Luther and the Lutheran Confessions, particularly Article I of the Formula of Concord, show an appreciation for essential man and keep a reasonable distinction between what the Formula calls the substantia of man over against his accidens or sinfulness.

This distinction enables the theologian and Seelsorger to deal with man both with a recognition of the heavy pull of Original Sin as well as with the possibilities of essential man under the grace of God. Man is not transformed by some supernatural alchemy. His transformation is made possible by the release and new motivation made possible through the experience of the grace of God in Christ.

Concrete illustrations of the "natural" in terms of epithymia, eros, and agape are given as well as of the impact on these human loves of both the "unnatural" in its destructive and the grace of God in its redemptive functions. It is through the understanding of these drives as given with creation that the theologian and pastor can deal realistically with man in the recognition of destructive as well as constructive factors involved in man's quest for self-realization and self-fulfilment in community.

A European Lutheran theologian, Anders Nygren, is cited to illustrate the concern of this dissertation. Nygren is well-advised when he distinguishes agape and eros as opposite motifs. But he is ill-advised when he presents the two as existentially at odds with each other. It is rather when the agape of God comes to the eros of man that the latter is delivered from its being curved in upon itself in order that it may move forward toward the realization of the divine design for eros-fulfilment in man.

Another European theologian, Dietrich Bonhoeffer, grasps this profoundly. He views the human body, "housing, food, clothing, recreation, play and sex," reason, vocation as realities in God's world for which the Christian accepts responsibility and seeks their proper realization in line with the mind of Christ. Bonhoeffer's writings and life are cited briefly to illustrate this concern of the dissertation.

The love of God does not "war" against the "natural," but against the "unnatural." This has important implications for the Christian ethic and for a helpful understanding of man and of the function of God's redemptive love.

Microfilm $2.20; Xerox $7.80. 167 pages.

THE CORRELATION OF LOVE AND LAW IN THE THEOLOGY OF JOHN WESLEY

(L. C. Card No. Mic 59-4121)

Charles Randall Wilson, Ph.D.
Vanderbilt University, 1959

Supervisor: Professor Paul S. Sanders

An apprehension of Wesley's understanding of love and law provides a clue to the meaning of religion and its relation to ethics. For Wesley love and law are intrinsic to the divine covenant for renewing man in followship with God.

Wesley's thought is theocentric and his understanding of God is derived from the relationship which man has to God. Man is a creature made in the image of God to the end that he might reflect His righteousness. It is in this relational context with its theocentric basis that the character and function of love and law become significant in Wesley's thought.

In explicating Wesley's understanding of love and law the dissertation moves through three stages: (1) it examines the historical development of these motifs in Wesley's thought; (2) it makes a systematic analysis of their relation; (3) it sets forth the ethical implications of Wesley's conceptions of love and law.

(1). This historical development of Wesley's thought shows continuity despite certain shifts of emphasis. He conceives salvation in terms of the restoration of fellowship with God, thus renewing man in the moral image of righteousness. Wesley affirmed that man's renewal is conditioned upon the divinely instituted means of grace.

In the chronological development of Wesley's thought there is a radical change from his earlier anthropocentric conception of salvation as achieved by works of the law to the theocentric position of believing for salvation as the gift of God's love. The events of 1738 which cluster about his Aldersgate experience epitomize the shift. This theocentric view is later modified to include not only God's love but also His law as essential for man's renewal in the image of righteousness.

(2). The systematic analysis of love reveals that it has both the divine and human expressions. The love of God to man has its supreme expression in Jesus Christ and makes possible man's restoration through his adoption and regeneration. The responding human expression of love is gratitude to God and beneficent good will to others. Wesley sees the law in terms of moral obligation. He interprets it in a Platonic manner as the reflection of the divine will.

Love and law are brought into a definitive relationship by Wesley. The inevitability of tension between them is acknowledged. At the same time their correlative relation is established.

(3). The ethical emphasis in Wesley's thought is based on the righteousness of God. He has established His covenant of grace and will fulfill His gracious promise. As a result, God's love is the originating factor in the atonement of Jesus Christ which makes saving grace possible for man. Salvation by grace introduces man to the privileges and responsibilities of Christian living which are summarily given in the teachings of Jesus. Wesley finds their specific ethical content to be "holiness without which no man shall see the Lord," and this implies that Christian ethics is related to final salvation. Two representative problems emerge from the discussion on ethical implications: (1) libertarianism inherent in the idea of love; (2) legalism inherent in the idea of law.

The real issue in Wesley's thought is a theocentric as over against an anthropocentric religion. God encounters man through the revelation of His love and His law. On the plane of history these correlative factors in God's activity confront man in the tension existing between the indicative and imperative aspects of the Christian life. Wesley saw God at work through His love and His law, combatting sin by renewing man's relationship to Him thus renewing man in the image of righteousness. Unbroken communion is renewed as man continually responds in repentance and faith.

Microfilm $2.75; Xerox $9.60. 212 pages.

PAULINE ESCHATOLOGY IN THE WRITINGS OF R. H. CHARLES AND ALBERT SCHWEITZER

(L. C. Card No. Mic 59-3656)

Paul Richard Woudenberg, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Edwin P. Booth

The primitive Christian hope of the immediate coming of the Kingdom of God was based on the memory of the teachings of Jesus. The fact that hope remained unfulfilled forced a transformation of the Christian faith which enabled it to survive the failure of the original expectation.

The place of Paul in this transformation has been uncertain. His early letters show a strong expectation of the Parousia, but scholarly opinion on the later letters remain contradictory. R. H. Charles has suggested that in Paul's later letters there is a noticeable decline in eschatological thought and, in effect, a transformation of Paul's original hope for the immediate Parousia. This transformation may be clearly shown by arranging Paul's letters into

four stages on the basis of the diminishing emphasis of eschatology. Albert Schweitzer has held that Paul maintains a consistent eschatological hope throughout his letters.

The background of Charles' position was rooted in the work of F. C. Baur and the Tübingen School and culminated with H. J. Holtzmann. This background centered about two questions of Pauline doctrine: 1. Its relationship to primitive Christianity, 2. Its relationship to Hellenistic ideas. The Tübingen School explained the decline of eschatology on the hypothesis that Paul introduced Hellenistic thought. Schweitzer regarded this explanation as unfounded and attempted to demonstrate that there were no clear affinities between the thought of Paul and the Hellenistic world. Paul's thought thus did not develop in any Hellenistic direction but remained consistently Jewish eschatological throughout his literary production.

The purpose of this dissertation is to outline and criticize the Pauline eschatological theory of R. H. Charles in the light of Schweitzer's thorough-going eschatology with particular reference to the Parousia.

The two positions are first compared on the basis of their relationship to critical norms regarding the Pauline corpus. These norms reject the authenticity of Ephesians and the Pastorals and establish the genuineness of nine letters. These genuine letters are chronologically arranged into three groups, each group being separated by a period of three or four years.

The eschatological material in the letters is then isolated and analyzed under three headings: the imminent expectation of the Parousia, the immediate resurrection upon death, and the eschatological chronology. This last heading is subdivided into the problem of the temporary Messianic Kingdom and a dual resurrection. The results of this analysis are applied to an evaluation of the two positions with the following results:

1. There is a consistent imminent hope for the Parousia throughout Paul's letters sustaining Schweitzer's basic position. There is no evidence for a correlation of this hope with the dating of the letters. Charles' failure to acknowledge the eschatological evidence of Philippians is a primary objection to his developmental argument.

2. In the light of the possibility of his own death prior to the Parousia, Paul revises his concept of the time of the resurrection in the Imprisonment Letters, arriving at a new doctrine of immediate resurrection. It is uncertain whether or not Paul wishes to apply this new doctrine only to his own death.

3. Evidence for a Messianic Kingdom is limited to a single passage in I Corinthians which does not adequately support Schweitzer's theory, a theory which is based primarily on non-Pauline materials.

4. Paul believes in a single resurrection for the righteous only. Schweitzer's reconstruction of eschatological chronology, which includes a dual resurrection, is based on non-Pauline materials.

Insofar as the eschatological evidence is concerned, Paul seems to stand apart from the process of Hellenization and, despite the possibility of his introduction of the doctrine of immediate resurrection, he remains within the Jewish eschatological framework.

Microfilm $2.80; Xerox $9.60. 215 pages.

SOCIAL PSYCHOLOGY

PUBLIC EXPRESSION VERSUS PRIVATE OPINION ON A CONTROVERSIAL ISSUE

(L. C. Card No. Mic 59-4052)

Joseph Aposhyan, Ph.D.
Columbia University, 1959

Modification of the frame of reference within which an individual perceives an attitude object may cause varying responses in the expression of attitude. In recent years, many studies have operated under the general assumption that in a group, an individual's attitude is related to his "perception of the group consensus." If an experimental distinction is made between an individual's private views and public expression of his views, would a modification in the public expression of private views take place?

Three national groups, Arabs (N=70), Americans (N=140), and Israelis (N=70), were employed for this research and were tested on their views regarding the Arab-Israeli conflict. A Thurstone-type scale, offering attitudinal statements covering the complete range from extreme positiveness to extreme negativeness with respect to the given issue, was used. Three forms of the attitude scale were constructed and were identical in statement content, but differed in the printed instructions to the subjects. On Form A, the subjects were asked to indicate their PERSONAL VIEWS; on Form B, their ESTIMATE OF THE PUBLIC VIEW in their own country; and on Form C, their PUBLIC EXPRESSION OF VIEW by checking the items on which they would be willing to be quoted and signing their names.

It was hypothesized that on an issue so chosen to have high or nearly perfect agreement in a group, the tendency for an individual in that group is to perceive the group attitude as being the most extreme, with public expression of his views next and his private views the least extreme. When an attitude object is of no particular relevance, regardless of "perception of group consensus," private and public expression of views are in agreement.

For the Arab group, significant differences were found between the mean scores of private views, estimate of the public views and public expression of views. These scores indicated that their "perception of group consensus" was the most extreme in regard to the Arab-Israeli conflict; their private views were the least extreme and intermediate to these two was their public expression of views.

For the Israeli group, no significant differences were found between the mean scores of their private views,

public expression of views and their "perception of group consensus." It is possible that under conditions of utmost relevance of an attitude object to a group of people, their private views, public expression of views and "perception of the group consensus" will stay essentially the same.

When the mean scores for the private views of the Arabs and Israelis were compared with the mean scores of their public expression of views, the difference in the mean scores of their private views was found to be significantly smaller than the difference between the mean scores of public expression of their views. In other words, the private views of the two antagonistic groups were closer together than public expression of their views in regard to the attitude object.

For the American group, no significant difference was found between the mean scores of their private views and that of their public expression of views. Based on these findings, the generalization might be made that in situations where an attitude object is of no particular relevance to a group and accordingly "perception of group consensus" is diversified, members of a group will feel no pressure to modify public expression of their private views.

Microfilm $2.00; Xerox $5.00. 98 pages.

COMMUNICATION PATTERNS AND PERSONALITY FACTORS AS DETERMINANTS OF ATTRACTION-TO-GROUP

(L. C. Card No. Mic 59-3830)

Mitchell Boris Balter, Ph.D.
The University of Connecticut, 1959

This study examined the influence of group structure and personality factors on three measures of attraction-to-group: (1) responses to a questionnaire designed to evaluate the attitude toward group and task which members develop as a consequence of working in the group; (2) social influence--the extent to which members could be influenced by the group norm in a size judgment; (3) the tendency for members to stay in or leave the group when forced to make a choice.

Five-person communication networks were used to vary group structure in a systematic manner. The networks differed along a dimension of centrality--the manner and degree to which members were interconnected. The five networks used in order of centrality were: Circle, Barred-Wheel, Chain, Y and Wheel. Personality traits were assessed by means of a questionnaire administered well in advance of the experimental session as part of a regular laboratory program in introductory psychology classes.

One hundred male subjects in twenty groups of five were tested on the experimental patterns. An experimental session for all groups consisted of the following sequence of events: (1) the group solved fifteen symbol problems in consecutive order; (2) group members made two successive judgments of the length of rectangle and on each occasion used the communication network to determine the average estimate of the group; (3) each member filled out a post-experimental questionnaire concerning his experience in the group; and (4) each member was forced to make a decision about participating in future meetings of the group.

Results

1. The results for networks reflected the differences in centrality among the communication patterns. The specific findings were as follows: (a) Job enjoyment ratings decreased from Circle to Wheel. (b) Ratings of group efficiency increased from Circle to Wheel with the exception of a modest reversal in the case of the Barred-Wheel and Chain networks. (c) With the exception of the Chain, mean convergence scores for networks were larger in the more centralized patterns. (d) The majority of members in the Circle, Barred-Wheel, and Chain networks attempted to stay in and maintain the group while the majority of Y and Wheel members attempted to leave the group.

2. Within patterns, the results for most variables formed a gradient from positions of low centrality to positions of high centrality. The specific findings for position were: (a) Job enjoyment increased from positions of low centrality to positions of high centrality. (b) Members ratings of group efficiency were independent of positional centrality. (c) A greater amount of convergence took place in positions of low centrality than in positions of medium or high centrality. (d) Attempts to leave the group were much more frequent in low centrality positions than in either medium or high centrality positions.

3. Job enjoyment ratings and attempts to leave the group were negatively correlated. The relationship between job enjoyment and social influence within positions was non-significant.

4. In positions of low centrality, more socially ascendant members tended to enjoy the job less, be less susceptible to group influence, and more prone to leave the group.

5. Insofar as there was an overlap in the data, the general pattern of results in this study was very similar to that reported by Leavitt in his 1951 study.

Conclusions

It was concluded that member satisfaction, frequency of attempts to leave the group, and susceptibility to social influence were a joint function of task role and positional centrality. Microfilm $2.40; Xerox $8.40. 183 pages.

THE EFFECT OF FEEDBACK ON ASPECTS OF THE ORGANIZATION OF SMALL GROUPS

(L. C. Card No. Mic 59-3447)

Norman Harrison Berkowitz, Ph.D.
Boston University Graduate School, 1959

Major Professor: Professor Robert Chin

A positive relationship is predictable between the level of feedback information about a group's performance and its degree of organization. For the increased stability of an individual's responses due to increased information enables the development of expectations about the behavior of group members, which may be tested against the available information. A validated set of expectations enables the coordination of responses resulting in a high level of group performance.

In this study the stability and coordination of Ss responses and the level of group performance provided the basis for inference about level of organization. These, in addition to "intrinsic job satisfaction" and "pride in group"

were the dependent variables. The independent variable of amount of information was conceptualized and experimentally manipulated in two ways: 1) the amount of information in feedback messages; 2) the number of recipients of the message. The amount of information contained in messages was varied in the following manner: Low - tells whether or not the group response was accurate; Medium - tells the direction of the error between the group response and the standard; High - tells the size and direction of the error.

The experiment was a 3 x 3 x 2 factorial design with three levels of information in messages, three variations of number of message recipients and two variations in the size of the group. The sample was 36 groups later reduced to 34 in the analysis. Assignment of Ss to groups was made randomly.

Hypotheses:

I. Increasing the amount of information to members about the performance of their group by increasing the amount of information in feedback messages or increasing number of message recipients will increase the level of organization as measured by 1) the stability of members' responses, 2) the coordination of responses and 3) the performance of the group.

II. Increasing the size of the group will decrease the level of organization as measured in I.

III. Increasing the amount of information in groups (as in I) will increase the members' intrinsic job satisfaction and pride in group.

The Task: Each S received a dial with a rotating pointer which could indicate any number from zero to ten. Each S was to indicate a number on his dial such that when it was added to the numbers selected by other members, the total would equal a target number which had been given to them at the beginning of the problem. There was a maximum of nine attempts (trials) to "hit" each target number. After each trial a feedback message was given to the appropriate number of Ss. There were ten target numbers, each of which constituted a separate problem. No intragroup communication was permitted throughout the experiment.

Dependent Measures: Stability - the average shift in response of an individual from trial to trial. Coordination - the average percentage of trials in which the shift of one S's response from the preceeding trial in no way negates or partially negates the shift in another S's response. Performance - the average discrepancy without regard to sign between the group's response and the target number. Satisfaction - measured by responses to a post-experimental questionnaire.

Analysis:

All hypotheses were tested using the analysis of variance statistic.

Results:

Increasing the information in feedback messages had the predicted effects on all three aspects of organization. Increasing the number of recipients had the predicted effects on stability and coordination of responses. There were no significant differences in respect to performance although the trends in the data also gave support to the predicted effects. The satisfaction data must be regarded as equivocal.

It is suggested that the experimental procedure used herein offers a method of examining the effects of many different variables on the development of organization. It is also believed that another useful method of conceptualizing amounts of information in groups has been offered, and additional research can be undertaken to determine its specific effects.

Microfilm $2.00; Xerox $5.80. 116 pages.

SOME EFFECTS UPON ORGANIZATIONAL CHANGE OF THE PERSONALITY CHARACTERISTICS OF KEY ROLE OCCUPANTS

(L. C. Card No. Mic 59-3929)

Carol Kaye, Ph.D.
University of Michigan, 1959

This investigation is an attempt to account for the variation in the results of an experimental program designed to increase productivity in a large-scale organization through increasing participation in decision-making. One division of the organization did show increased productivity as a result of downward delegation of authority and control, but the other did not.

The analysis is based upon interviews and questionnaires with three organizational levels--four managers, 36 supervisors and 366 clerks--comprising all members of the department involved in the program. These interviews and questionnaires were administered twice, once before the experimental program was launched, and then after the program had been in operation a year. The findings indicated different patterns of managerial-supervisory relationships before the introduction of the change program. With some managers, greater emphasis was placed on the needs of the supervisors and clerks. Other managers gave relatively greater emphasis to the organizational goal of productivity. The personality characteristics of the managers were the major determinant of the different ways in which the managers related to the supervisors and the clerks.

The original differences in the existing patterns of managerial-supervisory relationships were assumed to be conditioning factors with respect to the experimental change of increased decision-making.

Specifically, it was predicted that: (1) When individuals are well satisfied with their relationships with the superiors in the organization, they will perceive the change program as calling for little change on their part in spite of the requirements of the change program. (2) Where individuals are dissatisfied with their relationships with their superiors in the organization, they will perceive the change program as requiring significant change in their own behavior. (3) The actions of key members in an organizational hierarchy (in this organization, the manager) provides a model for subordinates in regard to organizational values concerning productivity and employee satisfaction. When conditions of change result in subordinates taking over responsibility for decision-making, the standards which guide their behavior will be those of the key organizational members.

Analysis of the supervisory and clerical reactions to the change program of downward delegation of decision-making supported these predictions.

To account for these findings a new concept is introduced, the pivotal role. A pivotal role is a point of leverage through which individuals affect organizational goals. It occurs when a role has a synthesizing function, which involves dealing with a conflict in expectations which are related to organizational goal attainment. The means to be used by the role occupant in carrying out the synthesizing function are not prescribed by the organization. This results in such occupants having a sphere of latitude in the handling of the conflict. Therefore, their personality characteristics become an important determinant of their handling of the synthesizing function.

Microfilm $3.10; Xerox $10.60. 239 pages.

DIFFERENTIATING FEATURES OF ORTHODOX, CONSERVATIVE, AND REFORM JEWISH GROUPS IN METROPOLITAN PHILADELPHIA

(L. C. Card No. Mic 59-2343)

Jack Porter, Ed.D.
Temple University, 1959

The Problem

The background for the present study is found in the increased interest in religious matters during recent decades, as determined by a marked increase in attendance at places of worship and in membership in institutionalized forms of such worship.

While this increase in interest and observance provides the general background for the study, its more specific purpose was to determine the extent to which this expressed interest is attended by conviction and acceptance of official doctrine, in this case the official doctrines and teachings of the three Jewish movements, identified as the Orthodox, Conservative, and Reform.

The literature calls attention not only to the intense interest which exists in the character of the Jewish religious movements in the United States, but also to the subjective and conflicting accounts which have been offered by writers dealing with doctrinal teachings of the three movements. The object of this study, then, is to gain a clearer picture of the population characteristics comprising the Orthodox, Conservative, and Reform Jewish movements in the metropolitan Philadelphia area. A secondary objective is concerned with the conditions responsible for affiliation with one movement rather than another.

Procedure

1. In the absence of any previous attempt to compile data of the type sought in this study, it was necessary to develop a questionnaire which would provide the desired information.
2. The following areas of interest were covered in the questionnaire:
   a. Place of residence and proximity of synagogue
   b. Family relations and sources of persuasion
   c. Relations with the non-Jewish community
   d. Adherence to observances and ritual
   e. Variations in acceptance of doctrinal concepts
   f. Education and socio-economic status
   g. Identifying data.
3. After preparation of the questionnaire, it was pretested on thirty individuals and certain minor changes were included in the final form used.
4. In the selection of the individuals to whom the questionnaires might be submitted the method of random sampling was employed.
5. A total of 614 copies were mailed (names having been acquired from fifty synagogues) with the sex factor equated in the sample selection. Approximately 200 questionnaires were sent to each of the movements.
6. Of the 614 copies mailed 327 were returned in useable and completed form.

Conclusions

1. The more traditionally minded Jews - the Orthodox and the Conservative - reside closer to their synagogues than do the Reform, with the synagogues of their choice also being the nearest synagogues.
2. In matters of affiliated membership within a given movement the Orthodox show the highest consistency, the Reform least with the Conservative occupying a middle position.
3. While the Orthodox and the Reform Jews all have their antecedents in traditional Judaism, "liberalization" seems to have been a step-by-step affair, from Orthodox to Conservative and from Conservative to Reform.
4. If there is a difference in the conditions affecting affiliation within the three movements it would appear that the Orthodox are more affected by family tradition, the Conservative by proximity of synagogue and opportunity for schooling, and the Reform by "conviction."
5. While the parents of congregants are, for the most part, foreign born, the congregants themselves are, for the most part, American born. The Reform show the highest number of American born and the Orthodox the fewest.
6. The Reform congregant appears to reflect greater social emphasis and community sensitivity than do the Orthodox and Conservative.
7. In the matter of education, participation seems to have been most extensive in the case of the Reform, least in the case of the Orthodox.
8. The typical congregant has received some amount of Hebrew and religious instruction. In this respect, the number receiving formal instruction has been higher for the Orthodox than for either of the other groups.
9. While Bar Mitzvah for boys is quite generally accepted, Bas Mitzvah for girls is at a much lower level, adherence being registered by about one-third of the Orthodox and Conservative and one-fourth of the Reform.

10. The Confirmation ceremony is confined largely to the Reform Movement.
11. Formal association with Zionism is more common among the Orthodox and Conservative than among the Reform.
12. In regard to occupational group, most of the women completing the questionnaire were housewives. In the case of the men, the majority were in business (owners or directors), in the professions or in managerial positions.
13. Most affiliated congregants fall within the age range of 30 to 60 years, with the Orthodox having the highest percentage in the 60 to 90 age range.
14. Of all the observances listed in the "Life Cycle" of the individual, circumcision rites showed highest acceptance by all groups.
15. The Reform group is more consistent in separating itself from the Conservative and Orthodox on matters relating to the more traditional ritualistic aspects of the Jewish faith.
16. In all items belonging in the personal prayer category, the Orthodox showed highest levels of acceptance. However, even the Orthodox exceeded the 50 percent mark on only 2 items.
17. In the area of personal prayer, there is high adherence and agreement only on one item.
18. The Reform are more apt to accept equality of education and of ceremonial observance for boys and girls.
19. All three groups are generally agreed that a child should not learn to "read" Hebrew without comprehension.
20. More extensive religious instruction periods are favored by the Orthodox.
21. In the matter of doctrinal concepts, the Orthodox and the Conservative seem to be less in agreement with the officially sponsored concepts of their own group than are the Reform.
22. That the most "liberal" group, the Reform, should show highest agreement with official teachings of their group seems to indicate that the "liberalizing movement" is more advanced among the congregants of the Orthodox and the Conservative Movements than among the leaders of these movements.
23. Actually, Orthodox membership shows greater agreement with the Conservative doctrine than with officially sponsored Orthodox doctrine.
24. Again, the Conservative group is more in accord with Reform doctrine than with Orthodox doctrine.

Microfilm $2.75; Xerox $9.60. 211 pages.

THE EFFECTS OF SMALL-GROUP MEMBERSHIP ON LEVEL OF CONCERN

(L. C. Card No. Mic 59-3772)

Lawrence Samuel Wrightsman, Jr., Ph.D.
University of Minnesota, 1959

Adviser: Stanley Schachter

The purpose of this study was to test experimentally two possible explanations for the finding that a person's desire to be with others increased when he was anxious. The two explanations were the expectation of direct anxiety reduction from being with others and the expectation of opportunities for self-evaluation through social comparison.

From the general hypotheses dealing with the effects of these contributions, two specific hypotheses were formulated:

1. If persons are anxious about an upcoming event, being with others is more effective in reducing their anxiety than is being alone.
2. Certain pressures toward uniformity in anxiety level, namely influence processes and rejection tendencies, will be elicited in groups of persons placed in an ambiguous emotional situation.

The experiment: Two hundred and four subjects (120 females, 84 males) participated in the laboratory experiment. Four different subjects of the same sex participated in each experimental session. Subjects were led to believe that they were going to participate in a painful and dangerous injection experiment; in general, the situation produced anxiety or concern in subjects. After each subject heard about the supposed experiment individually, he filled out a self-report measure of anxiety level. Then subjects in the Together-Talk condition were brought together and allowed to talk about anything for five minutes. Subjects in the Together-No-Talk condition were brought together but were not allowed to talk for the same period. Subjects in the Alone condition were told to wait in their separate rooms for the same time period. After the waiting period, the self-report measure of anxiety was repeated, along with other measures of anxiety level.

Conclusions: Strong support for the first hypothesis was obtained only in the case of subjects who were first or only children. First- and only-children subjects who waited with others showed a significantly greater reduction in anxiety level than did their counterparts who waited alone There were no condition-differences among later-children subjects. First-children subjects also showed greater gross change in anxiety as a result of waiting together, indicating that in anxiety-producing situations they are more influenced by the group than are later-children subjects. Results in the Together-No-Talk condition were generally similar to those in the Together-Talk condition, indicating that for first-born subjects, just being with others, without verbal communication, is anxiety reducing.

These findings tend to illuminate earlier findings of a greater desire in first-children subjects to be with others when anxious, for it now appears that their greater desire occurs because for them being with others is uniquely anxiety-reducing. A possible explanation for the birth-order difference is the greater anxiety-reducing nature of the mother for the first child, and the generalization of this quality to others.

The second hypothesis also received strong support. Pressures toward uniformity which normally emerge when one is trying to evaluate his opinion also emerged in the Together conditions in regard to anxiety level, and homogenization of anxiety levels occurred. No such tendency toward homogenization was found in sets of Alone-condition subjects. Greatest homogenization of anxiety levels occurred in Together-groups where the initial range of anxiety levels was moderate; this was interpreted to indicate that a certain amount of similarity in anxiety levels was necessary for social comparison to take place. It was concluded that a person's anxiety level is like an opinion in that it is partially cognitively determined and that one's level of emotion can be altered by information about the emotional level of others.

Microfilm $2.00; Xerox $5.00. 99 pages.

SOCIOLOGY

SOCIOLOGY, GENERAL

GEOGRAPHIC MOBILITY OF SELECTED RURAL MINNESOTA MALE HIGH SCHOOL GRADUATES

(L. C. Card No. Mic 59-3739)

Richard Walter Coller, Ph.D.
University of Minnesota, 1959

This study is an attempt to test the validity of a social explanation of migration which views migratory patterns as one mode of adapting to social pressures for success. Changes of residence are presumed to rise from searches for "opportunities" leading to success. Writings of Robert Merton and Margaret Mead are utilized in developing this frame of references.

Accordingly, rurality of residence during childhood and adolescence, level of father's occupation, occupational aspiration, military duty, year of high school graduation, age, career advancement, and reasons for moving were all hypothesized as having a significant positive association with patterns of migration. Young adult residence is considered an intervening variable and provides a cross-check on present location. Data were gathered as part of a cooperative project between the United States Department of Agriculture and the Department of Sociology of the Minnesota Agricultural Experiment Station.

A sample list of 912 male graduates for the years of 1948, 1950, 1952, 1954, and 1956 from five Minnesota rural high schools, was obtained from school records. Three schools were in Northeastern Minnesota, a low farming income area; while two schools were in the higher farming income Southwestern area. Addresses were obtained for 880 graduates, of whom 46 were interviewed and 834 mailed a questionnaire. Total return was 66 per cent (581 replies), after two follow-ups. Responses of the Southwestern and Northeastern graduates generally showed statistically significant differences between them, supporting statements about areal distinctness.

All the findings relate to three aspects of geographic mobility -- range, destination, and frequency of migration. Northeastern migrants tended toward either short or long-distance moves, whereas the Southwesterners clustered at intermediate locations. Variables most significantly associated with range were occupational aspiration, military experience, and career advancement. Early residence and reasons for migrating showed the least association.

Destinations of Northeastern migrants were most often large or small communities, whereas medium-sized centers attracted Southwestern respondents. Military experience showed the most consistently significant association with size of destination, but childhood residence and career advancement did so only for the Southwestern group. Reasons for moving showed least association with destination.

Destinations of migrants who went to only one size of community and others yielded contrasting patterns. Reasons for moving showed significant associations for all migrants who moved to only communities of one size category. Military duty, career advancement, and year of graduation are significantly associated only for Northeastern migrants in this particular category.

Data on the destinations of migrants who stayed within Minnesota was dichotomized into those who never residentially entered the metropolitan structure of Duluth or the Twin Cities versus those who established residence at least once in such a center after high school graduation. No significant difference appeared between migrants of the Northeast and Southwest on this aspect of migration. Reasons for moving showed generally significant association, but career advancement and young adult residence did so only for the Northeastern group.

The occurrence of migration is greater among Southwestern migrants. Half of the total sample migrated, paralleling other studies' findings. Military experience and career advancement were most significantly associated with geographic mobility. Frequency of moves showed almost no significant association with other variables.

About half of the hypotheses concerning migration and career opportunities and military experience are sustained; others are generally unsupported. Further research is suggested on military experience and migration, plus added attention to factors behind in-state migration.

Microfilm $3.40; Xerox $11.60 262 pages.

CONSEQUENCES OF OCCUPATIONAL MOBILITY IN A METROPOLITAN COMMUNITY

(L. C. Card No. Mic 59-3920)

Richard Farnsworth Curtis, Ph.D.
University of Michigan, 1959

The purpose of this study was to test a series of hypotheses regarding the consequences of intergenerational occupational mobility (between specified strata) on social participation. The social participation of mobile persons was expected to be less extensive than that of stable persons instructures characterized by predominantly primary -- but not necessarily in those characterized by predominantly secondary -- relationships. The consequences of mobility were expected to depend on the direction of mobility (upward contrasted with downward mobility), the degree of mobility (the social distance between strata of origin and destination), and the location of mobility (the specific strata of origin and destination).

The hypotheses were tested in a secondary analysis of sample surveys conducted by the Detroit Area Study in the metropolitan area of Detroit between 1952 and 1957. The sample included male, white, adult family heads, with the exception of farmers or the sons of farmers. Occupations were classified in four strata, based on Edwards' classification. Measures of participation in primary structures included rates of separation or divorce, a marital satisfaction scale, and reported frequency of attending extended family gatherings and visiting relatives, friends, neighbors, and work associates. The secondary structures considered included unions, churches, formal voluntary associations, and the political organization of the community. In addition, mobile and stable family heads were compared with respect to measures of class self identification and racial intolerance.

Rates of participation in primary structures generally tended to be lower among mobile than stable persons, but the differences were minute and within the range of sampling error. The relationships between mobility and participation in secondary structures were somewhat stronger, yet much weaker than expected, and often statistically insignificant. In secondary structures with a marked differential in membership according to status, e.g. labor unions and most formal voluntary associations, membership rates of mobile persons fell between extremes set by stable white collar and stable blue collar family heads. Rates of membership in churches were slightly higher among upwardly mobile, and slightly lower among downwardly mobile, than among stable persons. Rates of attendance were generally higher among mobile than stable church members. The consequences of mobility on political identification were quite limited. Mobile persons were somewhat more likely to vote, but less likely to contribute time or money, than stable persons.

The nature of relationships between mobility and social participation was frequently predictable from the theoretical orientation, but the extent of such relationships was much less than expected. This suggests (with the caution that the method may not have been adequate to produce the expected differences) that the consequences of mobility on social participation depend on the societal context to a degree not indicated in the theoretical framework. The consequences of integenerational occupational mobility in general, and moderate upward mobility in particular, may well have been mitigated in modern American society, by the normality of the experience, and by presumed cultural adaptations to it.

Microfilm $3.15; Xerox $10.80. 242 pages.

CAREER COMMITMENT AND STYLE OF LIFE IN THREE MIDDLE CLASS OCCUPATIONS

(L. C. Card No. Mic 59-3745)

Joel Emery Gerstl, Ph.D.
University of Minnesota, 1959

The objective of the study was to examine the major components of life style--work, leisure and consumption--as revealed in the contrast of three occupational groups. The focus was upon a horizontal dimension of stratification, since the occupations studied--admen, dentists and professors--represent divergent work milieus, not different societal strata.

Contrasts between the three occupations revealed the disparate setting of work and the nature of occupational ideology in each case. A major dimension of analysis was that of career commitment--the extent of dedication and involvement that an occupation holds for its incumbent. Measures of commitment included: responses to open-ended questions (e.g., job satisfactions, regrets about career choice, salience of occupation for self-image), mobility aspirations, activity in professional organizations, length of work week, fusion of work and leisure, prestige rating of own occupation, and the existence of an occupational community (the extent to which best friends are also colleagues).

The extreme contrast of work commitment and the meaning of work was between the dentists and the professors--with the admen holding an intermediate position. For the "Sauk College" professors, there is virtually no separation between their work and the rest of their lives. Their occupational role is not a means to an end, but rather an end in itself. The dentists, on the other hand, maintain a separation of work and non-work. They are committed to their career only to the extent that, it is the way that they make a living, spend some 40 hours of each week, and maintain necessary professional interchange in the semi-formal context of professional associations.

Consideration of leisure time activities involved further examination of the extent to which work roles are relevant in other aspects of daily life. Recreational patterns also indicated disparate patterns for each of the three groups, in many instances revealing occupational influences. The effect of occupation upon social life was seen most readily in the realm of participation in voluntary associations. These patterns also suggested differential status representations between dentists and admen, in spite of the fact that both are at the same socio-economic level. While much of the content of the standard consumption package was found to be standard in light of financial possibility, economic factors alone did not explain the deviations. Consistent occupational patterns were revealed for the dentists and admen when income was controlled. The highest paid admen maintain the symbols of high status; the most successful dentists do not. By contrast, the middle income

dentists accumulate the symbols of high status; the middle income admen do not. The lower incomes of the professors allowed some deviant case analysis.

Microfilm $3.25; Xerox $11.20. 252 pages.

THE ROLE OF THE BRACERO IN THE ECONOMIC AND CULTURAL DYNAMICS OF MEXICO: A CASE STUDY OF CHIHUAHUA

(L. C. Card No. Mic 59-3707)

Richard Humphris Hancock, Ph.D.
Stanford University, 1959

The purpose of this study, based on field investigation in the state of Chihuahua, was to determine the pattern of seasonal migration from Chihuahua to the United States and to evaluate the effect of this migration on the state and on the migrants themselves. An effort was made wherever possible to apply the results obtained to the national and international scene. Significant findings were:

1. Migrants usually come from depressed subsistence farming areas or from groups of farm workers that have congregated in urban centers.
2. From 1953 to 1958 migrants constituted 21 per cent of the economically active agricultural population and 11 per cent of the total labor force.
3. More money derived from migrant salaries than from any other single activity in the state except mining, cotton production, and beef cattle raising.
4. Migrants raised their level of living and that of their families, particularly in regard to food consumption, clothing, and housing.
5. Some migrants also used their wages for investment in farm equipment, land, animals and other factors of production.
6. Migrants received substantial benefits through new skills learned in the United States.
7. Migrants developed a friendlier feeling toward the United States than did non-migrants.
8. Migrants developed higher levels of economic aspiration through experience in the United States.
9. While some migrants complained of mistreatment by individual United States farmers, the migrant program is an overall factor in improving United States-Mexican relations on a personal level.

One of the worst features of the present program is that it increases Mexico's sensitivity to economic conditions in the United States, but none of the alternatives offered in its place seem to present a more desirable course of action. A return to the old wetback migration is out of the question; termination of the present program is unrealistic and would worsen relations between Mexico and the United States while presenting a legal problem on a par with that of enforcing racial integration in the South. Government-to-government aid could give the same impetus to the Mexican economy as do bracero earnings, but the cost in dollars would be extremely high in proportion to the results achieved. While it is obvious that there are inequities in the present program, there is a serious doubt that they can be entirely cured by legislative regulation or by tightening law enforcement procedures. In the final analysis the emigration of braceros is a manifestation of a labor surplus in Mexico, and can be most effectively halted by providing jobs for Mexican rural workers.

Microfilm $3.20; Xerox $10.80. 245 pages.

ADOLESCENT SOCIAL DISTANCE TOWARD OCCUPATIONAL STATUS

(L. C. Card No. Mic 59-4022)

John Warren Martin, Ph.D.
Indiana University, 1959

The objective of this research is to study attitudes toward occupations. More specifically, the study is concerned with measuring adolescent social distance toward fourteen selected occupations, two from each of seven categories in the Minnesota Occupational Scale.

The subjects who provided the data for this study were 462 ninth and twelfth grade students at Bloomington High School, located in Bloomington, Indiana, and 143 ninth and twelfth grade students at the Indiana University Laboratory School during the second semester of 1955.

Bloomington is in a rich dairy farming area and the center of the great Indiana limestone belt. Among its industries are furniture factories, a meat-packing plant, foundry and railroad shops, and radio and television plants. The 1950 census listed its population as 28,163.

The data presented are based upon (1) an Occupational Information Questionnaire, and (2) social distance scales. The latter are modifications of scales developed by Frank R. Westie for measuring race attitudes. These scales have been selected for two important reasons. First, since it is doubtful that attitudes toward races and occupations are general, these multiple scales with homogeneous content would appear to be more sensitive than, and thereby superior to, the traditional social distance scales which have unlike items placed along the same continuum. The three scales used in this study are concerned with three areas: residential proximity, power relationships, and interpersonal relationships. Secondly, it has been demonstrated that prestige is an attitude that varies with the perspective from which persons are viewed. Westie's scales have demonstrated an ability to discriminate the attitudes of subjects toward persons of varying occupational ranks, as well as an ability to show that social distance scores vary with the occupational status of the subject.

Some more specific objectives of this research are as follows:

1. To study the relationship between sex and attitudes toward occupations.
2. To study the relationship between age and attitudes toward occupations.
3. To study the relationship between socio-economic class and attitudes toward occupations.
4. To study the relationship between subjective class identification and attitudes toward occupations.
5. To study the relationship between occupational aspiration and attitudes toward occupations.

6. To search for attitudinal differences between students in a university laboratory school and students in the public high school of the same community, the latter of whom have parents who are more representative, occupationally, of the entire community.
7. To seek implications for theory in social psychology and sociology.

The principal findings of the study are as follows:

1. Generally, the higher the rank of an occupation, the lower the social distance score.
2. The differential total social distance scores toward the fourteen selected occupations yield a hierarchy that is strikingly similar to the prestige- and socio-economic scales which appear in the literature.
3. By and large, the subjects do not distinguish between white- and blue-collar occupations in assigning prestige.
4. There is some evidence of occupational centrism.
5. The few age and sex variations in social distance scores which exist are minor.
6. Social distance scores toward occupation extremes tend to vary with the occupational class of the respondent. For example, there is an inverse relationship between high occupational class and scores toward upper status occupations.
7. The responses of the subjects from the two schools differ, but the direction of scores are essentially the same.

Microfilm $3.65; Xerox $12.40. 281 pages.

SOCIALLY INDUCED STRESS AND ILLNESS: A STUDY IN MEDICAL SOCIOLOGY

(L. C. Card No. Mic 59-3714)

David Mechanic, Ph.D.
Stanford University, 1959

Some previous studies (e.g., L. E. Hinkle, Jr. and H. G. Wolff, "Health and the Social Environment: Experimental Investigations," in A. H. Leighton, J. A. Clausen and R. Wilson (eds.), Explorations in Social Psychiatry, New York: Basic Books, Inc., 1957,) have found that most illnesses are directly associated with stress experiences. Inasmuch as these conclusions are based entirely upon persons who have appeared for medical treatment, the investigators failed to control for influences such as the proneness to adopt the sick role. The present research was designed to take account of this variable, by investigating the sequence of events involving (a) the person's experience; (b) the development of symptoms; (c) the likelihood that he would respond to his symptoms by seeking treatment; and (d) his actual appearance at a medical facility.

The subjects were 614 university freshman males. Questionnaire data were obtained dealing with their perceptions of and experiences within the college environment; the stresses felt, the difficulties, satisfactions, and worries they expressed. Their proneness to adopt the sick role was measured by three questions ascertaining the probability that they would visit a physician under various hypothetical circumstances; the responses to the questions being combined into a proneness score. The relevant medical data (i.e., frequency of visits to the health service, number of diagnoses, type of diagnoses, etc.) were obtained from the students' health records for the freshman year. These medical data were recorded on a matrix which permitted the classification of each diagnosis in terms of the bodily system primarily involved and the presumed etiology.

In relating the two sets of data (i.e., questionnaire and medical records) a basic hypothesis was that visits to the health service would be a function of both perceived stress and the proneness to use such facilities. Another hypothesis stated that the most frequent visitors to the health service would be those who had experienced both great stress and a high proneness to adopt the sick role. Finally, it was expected that different types of illness (as classified) would be associated, respectively, with perceived stress and the proneness to use medical facilities.

The research findings confirm all of these hypotheses. Actual visits to a medical facility are significantly related to both stress and measured proneness to use medical facilities. When the two variables are combined, the high stress, high proneness group contributes the greatest percentage of persons who visit medical facilities frequently.

Perhaps most important was the finding that the measured proneness to seek medical aid was associated with the more common, familiar, and predictable illnesses such as respiratory, infectious bacterial, skin, gastric and viral. Stress, on the other hand, was significantly related to maladjustment and neuroses, mood maladjustments, allergic responses and, also, two or more traumatic conditions.

Such findings cast some doubt on the earlier findings mentioned above, because they indicate that the differential proneness to seek medical aid (or adopt the sick role) is a crucial variable in illness behavior, regardless of perceived stress; and that many effects attributed to stress may result from the differential proneness to use medical facilities.

In brief, how people behave when confronted with illness symptoms involves a complex web of interpersonal relations, differential needs and varied perceptions. Clearer specification of the variables involved, further conceptual development and more research are necessary. Illness behavior is much more complicated than has generally been assumed. Once we move away from its more obvious aspects, it is easy to oversimplify the "real" situation.

Microfilm $2.60; Xerox $9.00. 197 pages.

STATUS, VALUES, AND CERTAINTY OF OCCUPATIONAL CHOICE

(L. C. Card No. Mic 59-3715)

Donald Leon Mills, Ph.D.
Stanford University, 1959

The focus of this research is on the certainty of occupational choice expressed by a sample of male university

seniors. "Certainty" is conceived of in terms of degree, ranging from highly tentative to well crystallized occupational preference. An attempt is made to explore the relationship between selected social background factors and the degree of certainty indicated by the subjects sampled.

It is suggested that a value system relating to middle-class career orientation in the United States may reinforce the degree of certainty about occupational choice of male college students. It is hypothesized that the degree to which college students have internalized the open-class value system will be positively associated with their certainty of occupational choice. It was held also that middle-class status and role experiences generally condition or prepare the college senior for making a definite choice. That is, it was hypothesized that middle-class status and role characteristics are positively associated with certainty of the individual about his occupational choice.

A questionnaire was used to measure the relative effects of values, status and role variables upon certainty. The 249 Stanford senior males who provided usable data were assigned a score on an Index of Occupational Certainty. The dependent variable, certainty about the choice, was measured by subjects' replies to eight questions. The subjects also were given scores on the Index of Open-Class Value System Internalization, as determined from their responses to twenty-four value statements. The remaining independent variables involved nineteen measures of status and role experiences each of which was related to the certainty score. The association between certainty and the independent variables was measured largely by correlational techniques.

This research effort is exploratory in that the certainty dimension of decision-making studied here appears not to have been studied before, and the rather abstract writings concerning the open-class values system have been translated into empirical measures.

Among 219 subjects who were able to state an occupational choice (the "Choice Group"), there was little relationship between certainty scores and open-class value system internalization scores. There does appear to be some relationship, however, between values and certainty when an additional group of completely uncertain students (the "No Choice Group" of 30 subjects) was compared with the "Choice Group." Subjects who were unable to state an occupational choice clearly tended to score lower on the Index of Open-Class Value System Internalization than did the subjects who were able to indicate an occupational choice.

For the "Choice Group," five status and role factors appeared to be more strongly associated with certainty of occupational choice than any other tested. These were: religion, courtship behavior, presence of siblings, military status, and level of parental education. These five status and role factors were tested in combination by means of the multiple correlation for their joint association with certainty. The resulting correlation coefficient shows that these status and role variables together accounted for nearly twice as much of the variation in certainty scores as any single status or role variable. But the obtained multiple correlation value, $R = .44$, although significant, is not high enough to warrant the conclusion that these variables are overwhelmingly important in explaining certainty of choice. However, the various correlations do indicate clearly a pattern of association, and the correlations serve to focus attention on those areas which might be most fruitful for further and more intensive research on choice certainty.

Microfilm $2.00; Xerox $5.20. 105 pages.

SOCIOLOGY, SOCIALISM, COMMUNISM, ANARCHISM

THE MOTION PICTURE IN THE SOVIET UNION, 1918-1952: A SOCIOLOGICAL ANALYSIS

(L. C. Card No. Mic 59-4085)

John David Rimberg, Ph.D.
Columbia University, 1959

Students of the Soviet film industry have observed that the content of Soviet films is determined by the art and propaganda policies of the Communist Party. Some observers have also noted that film artists employed in Soviet studios have influenced the content of films, although artists are usually not members of the Communist Party. A few social scientists have suggested that film audiences, too, have definite preferences regarding film content, and that these preferences are taken into consideration by the Soviet film industry.

The thesis of this dissertation is that both film content and the volume of film production in the Soviet Union are determined by a process of compromise between Communist Party officials, film industry artists and the Soviet audiences who constitute the primary potential market for the exhibition of Soviet films. Compromise is necessary because the Party prefers political content, the artists prefer to create works of art and the audiences prefer entertaining films. Although these three preferences are not mutually exclusive, the divergent views need to be reconciled each time a film is produced. In the absence of successful compromise, the Party may choose to ban the exhibition of a film or even to interrupt its production, the artists may refuse to contribute their services, and the audiences may refuse to attend when the film is exhibited. Therefore the need for compromise is inescapable, if the Soviet film industry is to exist at all.

There is considerable evidence to substantiate this thesis. Sharp declines in the volume of film production can often be traced to a breakdown in the process of compromise. A comparison of the volume of film production and the extent of political propaganda content in films from year to year reveals an inverse relationship. The periods of maximum film production (1923-1928 and 1934-1945) coincided with the periods when propaganda content was relatively low. Vice versa, the periods of low film production (1929-1933 and 1946-1952) were characterized by increased political pressure for propaganda, resulting in a substantial decline in the number of film artists participating in productive activity at Soviet studios. In addition, an opinion survey among Soviet film-goers suggests that entertainment is the primary concern of the movie audience, which is prepared to accept only a limited amount of political propaganda. Therefore, the majority of films released by Soviet studios reflect compromises concerning film content to accommodate the conflicting views of the Communist Party, the film industry artists, and the potential film audiences in the USSR.

Microfilm $3.20; Xerox $10.80. 245 pages.

HROTSVITHA: THE THEATRICALITY OF HER PLAYS

(L. C. Card No. Mic 59-3915)

Sister Mary Marguerite Butler, R.S.M., Ph.D.
University of Michigan, 1959

In the perennial controversy, as to whether Hrotsvitha wrote her plays to be acted or read, the arguments both pro and con have been based on literary rather than theatrical criteria. There seems to be not a single instance in which scholars have argued their position from the practical theatre standpoint. Since there are apparently no documents which affirm or deny performance, and since it is unlikely that such verification may now be uncovered, this controversy will probably never be resolved conclusively. What can be determined conclusively, however, is the potentiality of the plays for performance. Therefore, this study is an attempt to present the dramatic works of Hrotsvitha of Gandersheim from the theatre viewpoint rather than from literary history.

In a critical approach to the theatricality of the plays, the writer advanced the hypothesis that they were given some kind of theatrical expression. One major assumption supported this view, namely, that Hrotsvitha would not have used such visual dialogue if she had not intended the plays for performance. Her purpose in dramatizing popular religious legends was to arouse attention and to attract to virtue. The dramatic form served her purpose best.

Hrotsvitha defies treatment in isolation. To understand her position as a dramatist it is necessary to define her place historically and to substantiate it experimentally. She lived in one of the most revolutionary periods of the middle ages--in a culture now considered the matrix of modern civilization, a culture rooted in spiritual energy and marked by intense social and political changes, a culture that spanned the fall of Rome and the glory of the Renaissance. Contrary to traditional opinion, a theatrical vacuum did not exist during this period. There have been found traces of classical, mimetic, and liturgical influences,--all of which left an impress on the works of Hrotsvitha.

Historical documentation attests that Gandersheim was a canoness-cloister, that is, a monastery with a unique blend of asceticism and worldliness and that Hrotsvitha was a canoness who enjoyed a certain freedom of experience and routine conducive to imaginative playwriting. The writer sought an acting area in the canoness cloister and found it inherent in the cloister-arcade of the tenth century.

Under the influence of three dramatic impulses--classical, mimetic, and liturgical--Hrotsvitha vested her dramas with features distinctly theatrical.

The classical tradition manifested itself primarily in the involvement with moral conflict and singleness of issue, and in the expressive dialogue and poetic style. Hrotsvitha borrowed satirical and farcical elements from the mimes. The liturgical influence showed itself in subject-matter selection and in Biblical allusions.

In lieu of historical data supporting the performance theory, the writer maintains that within these traces lies the potential for performance.

To further support theatricality, an experiment was designed and executed, namely, the production of "Dulcitius" and "Sapientia" at the University of Michigan. These two plays were subjected to a practical criteria involving dramatic significance, spectacle quality, and staging. It was agreed that the presentations were dramatically significant not only in their own right as drama but as art forms of the tenth century. Visual and aural representation, aesthetically profuse, insured the spectacle quality of both plays. The staging followed a natural sequence of movement and was admittedly convincing.

The generally restrained reaction of the audience to this experimental production was due to its uniqueness, to the employment of several unfamiliar stage conventions, and to the respect accorded by scholars to tradition and to Hrotsvitha in particular, who in her time produced a "new drama," characterized by a social motivation, a supernatural significance, a refined realism, and an expressive dialogue, unlike any in the past and foreshadowing many in the future. Microfilm $3.30; Xerox $11.20. 255 pages.

STUDENT SPEAKING AT THE UNIVERSITY OF MICHIGAN, 1841-1884

(L. C. Card No. Mic 59-3923)

Marvin Leonel Esch, Ph.D.
University of Michigan, 1959

This study is a description and analysis of student public speaking activities in the Literary College of the University of Michigan from 1841 through 1884. Little is known concerning the nature of speech work at the University until Thomas Clarkson Trueblood offered training in elocution in November, 1884. This study, therefore, contributes information dealing with the history of speech education in the Literary College during the earlier period. The primary sources used are largely those found in the Michigan Historical Collections and the University of Michigan libraries. Areas of investigation especially considered include the following: (1) the extra-curricular activities, including the speaking programs of the literary societies, (2) the co-curricular activities of the Commencement and class exhibition programs, and (3) the formal training in rhetorical exercises and public speaking within the English Department.

There were extensive extra-curricular programs in public speaking conducted by the literary societies from the 1840's through the 1870's. The Phi Phi Alpha, the Alpha Nu, and the Literary Adelphi were the most popular organizations. During the first twenty-five years most of the students in the Literary College belonged to one of

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

these groups. The organizations held debates, presented original orations, and read essays from their literary publications at the weekly meetings. In addition, the organizations often held semiannual public exhibitions. The debate activity of the societies was similar in some respects to that found in intercollegiate forensics today in terms of the types of debate, the topics selected, and the methods of determining decisions.

The class exhibition and Commencement programs afforded the student an unusual opportunity to speak in public. The class exhibitions were public speaking programs presented under the supervision of the faculty. There were two speaking occasions at Commencement: (1) in the graduating exercises, and (2) in the Class Day programs of Commencement week, at which time students selected by the seniors presented a class history, an oration, and a prophecy. Until 1861 all juniors presented speeches at the exhibitions, while all seniors performed in the graduating exercises. The students prepared for their performances through required weekly rhetorical exercises conducted by professors in the Rhetoric and English Language Department. Increased enrollment later made the prevailing policy of student speaking impracticable, and, therefore, beginning in 1861 the faculty selected the students who were to appear.

The contemporary newspaper comments regarding student speaking performances at times indicated that students had failed to receive specialized speech training at the University. The most frequent negative criticism concerned the commonplace and overworked subjects used by the students and the unnatural quality of their delivery.

The formal training in public speaking at the University may be classified in three periods: (1) The Early Period from 1841-52 was characterized by an emphasis upon traditional rhetorics and classical works; (2) The Middle Period from 1852-67 represented a gradual trend away from the oral aspects of rhetoric in favor of grammar, composition, and English literature; (3) The Later Period from 1867-84 was a time during which speech activities and training declined sharply. There were, nevertheless, several special courses in public speaking taught during the forty-four year period, including a course by Erastus O. Haven in 1854 entitled "Elocution," and a course in argumentation and debate taught in the 1870's and early 1880's.

In the 1870's and early 1880's there were occasions when both students and faculty members strongly recommended that the University establish a chair of elocution. In November, 1884, Thomas Clarkson Trueblood began teaching courses in elocution and in 1888 he was appointed Assistant Professor of Elocution and Oratory.

Microfilm $3.25; Xerox $11.00. 250 pages.

A COMPARISON OF PREDICTED AND ACTUAL AUDIENCE REACTION TO FOUR EDUCATIONAL TELEVISION PROGRAMS

(L. C. Card No. Mic 59-3927)

Barton Lovewell Griffith, Ph.D.
University of Michigan, 1959

The purpose of this study was to determine the ability of a group of persons experienced in educational television to predict actual reactions of viewers to educational television programs.

One representative program was selected from each of four representative ETV program series distributed by the Educational Television and Radio Center.

Twenty-three to 33 non-representative volunteers (Viewers) saw each program, in groups of around nine, via closed-circuit television. Reactions were obtained to eight reaction items: Tuning Reaction, Interest Level, Learning-facts, Learning-general ideas, Learning-something useful, Entertainment, Enjoyment, and Understanding and Following. Check-off questionnaires were answered at four time points: Before Show, at Ten and Twenty Minute Periods, and at End of Show. Two open-ended questions produced reactions to a program, its content, production and talent. Finally, each group participated in a 30 minute non-directed discussion.

Eight persons, representative of producer-directors most commonly found in ETV stations at the time of this experiment (1955), and qualified as practical Experts by education and experience in educational television, were selected to predict viewer reactions. Four were designated as A Experts and four as B Experts.

The A Experts were given demographic descriptions of Viewers of each program. During the showing of a program, these Experts made periodic predictions of Viewers' reactions. Check-off questionnaires almost identical with questionnaires of Viewers were used. One difference was substitution of a more detailed check-off and open-ended questionnaire for the Viewer open-ended questions and Viewer group discussions.

The B Experts predicted general audience reaction without knowing anything about the Viewers. Open-ended questions about a program, its content, production and talent were answered after each uninterrupted program viewing. Procedure used by B Experts, who preceded in time the A Experts and Viewers, also functioned to suggest improvements in procedures for Viewers and A Experts.

Quantitative data coded on each program were: 1. Mean scores of Viewers and A Experts on the eight reaction items compared at the four time points. 2. Practical significance of differences determined from a producer's point of view. 3. Consistent bias by Experts to over- or under-estimate Viewers' reactions. 4. Amount of agreement or disagreement among Experts and among Viewers.

Qualitative data on each program derived from open-ended questions and discussions of Viewers and from questionnaires of A and B Experts were analyzed under Content, Production and Talent. Analysis consisted of (1) The number of Viewers and Experts commenting positively or negatively about various program aspects and (2) The rank order of comments mentioned by Viewers and by Experts.

Quantitative results were: (1) Experts failed to predict reactions of Viewers from a practical standpoint (a) to the eight reaction items, (b) at the four time points and (c) to the four programs. (2) Experts consistently tended to under-estimate reactions of Viewers. (3) While Experts tended toward more general agreement among themselves than did the Viewers, neither were in general agreement among themselves on most items.

Qualitative results were: (1) Experts did not predict Viewer positive and negative reaction about various aspects of the four programs. (2) Experts did not predict Viewer Comment about various aspects of the four programs.

A general conclusion regarding ability of Experts to predict both Viewer quantitative and qualitative reactions, is that the Experts were not reliable "predictors" of these reactions. This general conclusion should not, however, be projected and applied as yet to any larger population because of the number and characteristics of the Viewers and Experts used in this experiment. Nevertheless, the study does propose a working hypothesis for future experimentation. Microfilm $4.00; Xerox $13.40. 309 pages.

AMERICAN FARCE ON BROADWAY, 1914 to 1950

(L. C. Card No. Mic 59-3706)

LeRoy Day Haberman, Ph.D.
Stanford University, 1959

One of the paradoxes of the American theatre lies in the fact that although farce once played a great part in supporting the commercial drama by insuring the patronage of the popular audience, the venerable form has been accorded scant attention by critics and students of drama. This study is an attempt to indicate the state of farce on the Broadway stage in the period from 1914 to 1950. In brief, the purposes of the dissertation are threefold: (1) to present an historical picture of farce in the period under scrutiny, (2) to examine the structure of American farce from 1914 to 1950, and (3) to attempt to evaluate the place of farce in American drama during the period.

The methods of the dissertation are not complex. First, a working definition of farce has been evolved from earlier studies on the subject, in addition to critical reviews, articles and the farces of the period. Second, an indication of the extent of farce material on Broadway between 1914 and 1950 is given by setting forth a season-by-season survey of farce productions. Third, an examination of a number of representative farces of the period is employed to point out trends in subject matter, plot structure, characterization, dialogue writing, and the use of spectacle. Finally, critical reviews and pronouncements have been utilized to furnish an insight into the critical attitude toward farce and the place of farce on the American stage from 1914 to 1950.

During the thirty-six year period of the study, farce was profoundly affected by a number of forces. By 1914, the motion picture industry had developed sufficiently to threaten the prosperity of the Broadway theatre. As the film medium grew, it drew away the popular audience and the producers, writers, actors and directors who had been instrumental in farce productions in New York. With the coming of World War I, farce was further influenced by the changing morality of the stage. Shortly after the end of the war, a new entertainment medium--commercial radio--came into being and proved a third significant influence upon farce. A few years later, in 1926, the talking picture was developed, and even more stage workers emigrated to Hollywood, The list of events and innovations which affected farce between 1914 and 1950 includes also the market crash of 1929 and the subsequent depression, World War II, and the rapid growth of television that came after 1947. The ultimate result of the competition among the motion picture industry, television, and the theatre was a gradual decline in the number of farces offered on Broadway from 1914 to 1950.

All in all, the best of the farces written between 1914 and 1950 were better plays than the long-running exhibits of the nineteenth and early twentieth centuries. By 1950, fewer farces were being produced per season than had been produced at the time of World War I, but these few farces were, in general, better examples of playwriting than their predecessors, and they enjoyed substantially longer runs on the Broadway stage.

Microfilm $4.[illegible], Xerox $13.80. 316 pages.

AMERICAN DRAMA CRITICS' REACTIONS TO PRODUCTIONS OF AUGUST STRINDBERG

(L. C. Card No. Mic 59-3748)

Ralph H. Haugen, Ph.D.
University of Minnesota, 1959

Adviser: K. L. Graham

The purpose of this study was to record and analyze the main points of criticism of American drama critics to the productions of August Strindberg on Broadway from 1912 through 1956. The chapters which comprise this study are: I. Introduction, II. Rapid Survey of Strindberg Productions on Broadway, III. Strindberg—A Psychological Oddity or a Serious Dramatist?, IV. Criticisms of Content and Form, V. Theatrical Effectiveness of Strindberg's Plays, VI. Strindberg's Potential on the American Stage and VII. Conclusions. Appendix One of this study is a record of the theatrical data of Strindberg's plays produced in New York City from 1912 through 1956, and appendix two is a compilation of the results of a questionnaire sent to present day critics.

From 1912 through 1956, thirty productions were staged, however in these thirty productions only twelve plays are represented. Thirty productions is indeed a very small number for a dramatist considered to be a leader in the development of modern drama.

While it is difficult to guage the exact influence that drama critics have had in conditioning the publics' attitude toward a Strindberg production, it is possible to conclude from their reviews the status of Strindberg on Broadway. There seems to be a close correlation between the quality of a stage presentation and the critics' estimate of a play. Generally the productions of Strindberg's plays have been poor. Such productions furthered the impression that the fault was intrinsically in the drama. However, the three plays that were staged effectively were praised by the critics.

A criticism most consistently developed by the majority of the reviewers was the opinion that Strindberg lacked sublimation. Other points of adverse criticism developed were:

1. That Strindberg was too erratic as a person to achieve anything more than limited audiences in the United States;
2. That his ideas were too pessimistic and archaic;
3. That although his naturalistic form was commendable, his expressionism was too obscure;
4. That his characters were abnormal.

The play reviewers developed little constructive criticism concerning the acting, the direction, and the design of the productions. Many early critics, however, noted that the plays were not suitable for the commercial stage.

During the forty-four year period studied, there

has been some progress in the quality of the reviews as well as some significant changes in the critics' reactions. The very prejudiced reactions against Strindberg were most often encountered in the early reviews. The opinion that Strindberg's ideas were too pessimistic, that his plays were archaic and that his characters were too abnormal for commercial theatre is not held by most present day critics.

The attempt to establish a relationship between the quality of acting and the effectiveness of a play is of recent origin. Too frequently in the past, the blame for a poor production was placed directly on Strindberg. Yet, the evidence of the reviews suggests that the acting, directing and design were most instrumental in shaping a critic's reactions to a production. There has been at least a tardy recognition by some critics that we have not had the actors and the kind of theatre able to produce Strindberg effectively.

Whether Strindberg would be accorded a better reception from Broadway audiences today is hypothetical. The theatrical effectiveness of the 1949 productions plus the fact that productions since 1949 have tended to have better reviews and longer runs than earlier presentations suggests that Strindberg probably would be favorably received today if his plays were given excellent production.

Microfilm $2.10; Xerox $7.40. 158 pages.

CREATIVE ROLE-PLAYING AS THERAPY FOR STUTTERING CHILDREN; WITH SPECIAL REFERENCE TO THE USE OF MASKS

(L. C. Card No. Mic 59-2080)

Harold Dennis Homefield, Ph.D.
New York University, 1959

This experimental study investigated creative role-playing as therapy for stuttering children. A basic assumption was, that stuttering in children is symptomatic of a disturbed emotional background with a parental matrix. The hypothesis tested was, that -- through the medium of role-playing therapy -- catharsis could result from a limited re-exposure of the disturbed child to the types of emotional situations with which he had been unable to cope. The function of masks in relation to the therapy procedures was also evaluated.

Eighteen stuttering boys of elementary-school age were divided into three equated groups which met separately once weekly for hour-long role-playing sessions. One group never used masks. Of the two remaining groups, one used masks during the first eight-weeks only, while the other wore masks only during the second eight-weeks of therapy. All three groups were exposed to the same basic plot, but were permitted wide latitude in their interpretations of the roles. Testing was done initially one week prior to the first therapy session. The groups were then tested periodically after eight, sixteen, and twenty-four weeks of role-playing.

The test material consisted of a number of picture clippings from popular magazines showing children and adults in various moods or states of action. As a means of evoking propositional speech, the pictures were shown to the child and he was asked to tell what he saw and what he thought was happening. The child's replies were recorded for exactly five minutes, and became the five-minute frequency (of blocking) test. Upon completion of the experiment, these tests were submitted to a group of judges who determined the number of non-fluencies. By using a form devised for the present study, the judges were enabled to measure the number of blocks and to classify them in a single operation.

Ten-second samples of the non-fluencies encountered in the five-minute tests were transcribed for qualitative evaluation of their severity, based upon duration and intensity. These severity appraisals were performed by a second group of judges, and were known as the severity test scores. The statistical findings of the present research are dependent upon the severity scores.

Conclusions

The present investigation demonstrated that creative role-playing, in a relatively permissive atmosphere, is a useful method of therapy in the symptomatic alleviation of the stuttering syndrome. To obtain measurable improvement, however, it should be conducted for a period of at least twenty-four weeks. Most children speak more fluently during role-playing than during their usual propositional speech. This fluency is increased if the child plays an authoritarian role, or one in which he engages in bodily motions. When masks are used in the initial stages of role-playing, they accelerate the actor's ability to sublimate his identity and to appropriate the character of the role. It was also found that syllable repetitions were the most common form of non-fluency.

Microfilm $2.00; Xerox $6.80. 141 pages.

THE REACTION OF THE CATHOLIC CHURCH TO THE COMMERCIAL THEATRE IN NEW YORK CITY, 1900 to 1958

(L. C. Card No. Mic 59-3803)

Michael Francis Kelly, Ph.D.
State University of Iowa, 1959

Chairman: Assistant Professor Ronald C. Gee

One of the most persistent concerns of the Roman Catholic Church is the problem of decency in entertainment. In the United States, the area of entertainment in which Catholic opinion has been the most sharply divided and undergone the most significant development has been that of the legitimate theatre. It is the purpose of this dissertation to investigate this reaction of the Catholic Church to commercial theatre in New York City from 1900 to 1958.

The reactions with which the author is concerned have taken several forms: spoken and written statements; formation, resurgence, abatement, and discontinuance of organizations; and miscellaneous activity by individuals and groups. By studying this activity on the part of members of the Catholic clergy, laity, and organizations thereof, a total picture of Church reaction to the stage is sought. Since New York City is the country's one true theatrical center, the author has focused his attention on that theatre and on the Church within that Archdiocese, although occasional references are made to situations elsewhere when

pertinent to the topic under discussion. Theatrical fare considered is primarily the standard drama; burlesque and revue are included when important.

One of the most pertinent conclusions to be made on the basis of these fifty years of Catholic reaction to Broadway is that there is no such thing as a Catholic attitude. Even though all Catholic opinions are based on the same unchanging set of moral principles, interpretations of these principles as they related to theatre and theatre-goers have varied widely among Catholics -- clerical and lay -- throughout the years. This variation has normally had correlation to the liberalism or conservatism of the individual or group and their knowledge of theatre and audience behavior.

The general tenor of Catholic reaction has undergone a marked change during the period under study. Whereas the years up to the late 1930's witnessed an emphasis of censorial, negative reaction on the part of the Church, the years since that time have seen censorship advocacy subside in favor of constructive, positive activity. During the first period, the most active group was the Catholic Theatre Movement, a moral evaluation agency for the stage; in addition, Catholics participated heavily in debate over proposals for legal censorship in 1927, 1930-31, and 1937. The second period saw the increasing encouragement of Catholic production, seen especially in the National Catholic Theatre Conference and the Blackfriars' Guild. Only once since 1945 has the Church risen in collective wrath against Broadway, and that concerned burlesque. Almost all current Catholic theatre-related groups are focused upon a propagation of Catholic dramatic production or on a ministration to the needs of Catholics within the theatrical profession, rather than a hurling of charges at Broadway. Even the critics for the Catholic press, whose role necessitates that they consider the moral, as well as the aesthetic, content of commercial fare, continually stress the importance of Catholic production.

Representatives of the Church have always felt constrained to judge theatre on the basis of both morals and aesthetics. Many of the most striking differences of Catholic opinion have lain in the relative importance assigned to these two criteria. It is with this, and with the gradual change from negative to positive action, that this dissertation is primarily concerned.

Microfilm $3.95; Xerox $13.20. 305 pages.

THE PERSUASIVE STYLE AND APPEALS OF THE MINOR PROPHETS AMOS, HOSEA, AND MICAH

(L. C. Card No. Mic 59-3935)

Ralph Loren Lewis, Ph.D.
University of Michigan, 1959

The major objectives of this study are: (1) to identify the dominant stylistic characteristics of the writings of Amos, Hosea, and Micah; (2) to discover the persuasive appeals which arise from the subject matter and style of the three prophets; and (3) to set forth similarities and differences with regard to language choices, sentence structure, and appeals. Stylistic elements are considered under the inclusive headings of (1) clearness, (2) energy, and (3) suggestiveness. The three modes of persuasion commonly named by writers of rhetorical theory as logical, emotional, and ethical are analyzed in each of the three prophetic works. The major appeals employed by the prophets are divided into a positive group containing elements of faith and a negative group based upon some element of fear. While the components of style and appeals are treated individually in this study, all of these elements combine in the total process of persuasion. There is a coordination of logic, authority, ethos, and emotion together with the various stylistic characteristics of each prophet.

The analysis of these works reveals that each of the three prophets excels in one of the three elements of style. (1) Amos excels in energy (and rhythm). He demonstrates the effective use of suspense, surprise, progressive movement, and climax. (2) Hosea's message leads in suggestiveness. Of the 1,044 images found in the three works, Hosea's book ranks first in each classification of imagery as follows: 98 visual, 46 auditory, 55 gustatory, 6 olfactory, 34 tactual, 129 kinaesthetic, and 234 organic. Hosea's work contains more similes and metaphors than any other Old Testament writing. (3) The book of Micah shows a higher level of clarity then the books of the other two prophets. He uses shorter, simple sentences; he employs more direct discourse.

The prophets employ strong, frequent, and varied appeals. Negative appeals based upon elements of fear are dominant in each book. In the speeches of Amos 91.9 per cent of the appeals are negative; in those of Hosea 81.9 per cent are negative; and in those of Micah 71 per cent are negative. The most common negative appeals are guilt, desire for security, and fear of suffering. Positive appeals based upon faith are employed more frequently by Micah than by either Amos or Hosea. In the speeches of Micah 29 per cent of the appeals are positive; in those of Hosea 18.9 per cent are positive; and in those of Amos only 8.9 per cent are positive. In other words, while 71 per cent of Micah's appeals are negative, yet proportionately he employs over three times as many positive appeals as Amos, and over two times as many as Hosea.

Although the prophets use negative appeals predominately, they nevertheless proclaim a strong positive message. Speakers in biblical days who fail to use negative appeals are called false prophets who speak "smooth things" of human origin, without regard to the harsher elements of divinely given insight or inspiration. True prophets are generally regarded as persons who combine appeals to faith and to fear with the force of their reason, their personal influence, and the vigor of their style to advance the message of God. Their works serve as impressive examples of persuasive speech largely because of their intensity, their imagery, and their enduring ideas of justice, loving-forgiveness, and mercy.

Microfilm $2.95; Xerox $10.20. 227 pages.

A STUDY OF LEWIS CASS AND HIS UNITED STATES SENATE SPEECHES ON POPULAR SOVEREIGNTY

(L. C. Card No. Mic 59-3960)

Walter William Stevens, Ph.D.
University of Michigan, 1959

This study is a description and analysis of the public speaking of Lewis Cass in the United States Senate as manifested in his speeches dealing with the doctrine of popular sovereignty. Specifically, the study consists of (1) a biographical sketch of Lewis Cass, (2) an investigation of the principle of popular sovereignty, (3) a rhetorical analysis of the popular sovereignty speeches of Cass which were presented in the Senate, and (4) a report of the response to his speeches as revealed by views expressed largely by his contemporaries. The chief depositories of primary materials relating to Cass which were consulted for this study were the Michigan Historical Collections and the William L. Clements Library, both of which are located at the University of Michigan, and the Burton Historical Collection in the Detroit Public Library.

Lewis Cass distinguished himself as governor of Michigan Territory from 1813-31, at which time he was appointed Secretary of War (1831-36) and later minister to France (1836-42) by Andrew Jackson. In 1848 Cass was unsuccessful as the Democratic candidate for the presidency. After serving two terms in the United States Senate from 1845-57, the Michigan statesman held the office of Secretary of State under Buchanan until his retirement in 1861.

The conclusions drawn from this study are as follows:

1. Popular sovereignty was the major political thesis expressed by Cass during his Senate career. Although the doctrine can be traced back as far as the American colonial period, it was Cass who was the first clearly and formally to introduce it as an active political principle in American government with respect to the slavery issue.

2. The popular sovereignty speeches of Cass followed a topical pattern of organization and were developed inductively with a wide variety of supporting materials, the most prominent of which was "authority."

3. Cass generally employed a brief statement-of-purpose type introduction and a carefully planned, mildly emotional conclusion.

4. The techniques of refutation which were used most often by Cass were those of overwhelming evidence and authority of the Constitution. He also relied considerably upon definition, lack of need, repudiation and dismissal, comparison and contrast, and reductio ad absurdum. Admission, sarcasm, and surprise and amazement received limited use.

5. Cass avoided intensely emotional persuasion in his Senate addresses dealing with popular sovereignty. The emotional appeals most common to his speeches were to security, brotherhood, justice, esteem, patriotism, and religion. The entreaties to patriotism and religion were by far the most numerous.

6. The persuasive force exerted by the personality and character of Cass was enhanced by his honesty and his effective influence in man-to-man relationships. His colorless public personality and his ambition, however, worked against him.

7. Although Cass was capable of considerable language embellishment in his ceremonial speeches which were presented outside the Senate, his addresses in Congress were characterized by the plain style.

8. Cass who was elderly and physically unattractive by the time he reached the Senate, usually delivered his speeches in an unenthusiastic manner.

9. Cass managed to get a favorable response to his doctrine of popular sovereignty in the Senate in 1854 only to see it fail when it was put to the test in the territory of Kansas. Microfilm $4.85; Xerox $16.20. 380 pages.

AN INVESTIGATION OF THE RELATIONSHIP BETWEEN DEFECTS OF SPEECH AND READING ACHIEVEMENT, INCLUDING A STUDY OF THE EFFECTS OF SPEECH THERAPY ON READING ACHIEVEMENT

(L. C. Card No. Mic 59-2094)

Jack Tureen, Ph.D.
New York University, 1959

The purpose of this investigation was twofold: (1) to determine whether a significant relationship existed between defects of speech and reading achievement, and (2) to investigate the effects of speech therapy on reading achievement. The experimental population consisted of two groups, each of forty speech defective children, selected from the clinical population of one school in the New York City public school system. Grade placement ranged from the second through the sixth year. The experimental and control groups were matched on the variables of: type of speech defect, school grade, reading ability, intelligence, age, and sex.

The Primary, Elementary, and Intermediate Batteries (Form J) of the Stanford Reading Achievement Tests were used to measure reading achievement at the beginning of the experimental period. Intelligence was measured by the Alpha and Beta forms of the Otis Quick-Scoring Test. Three minute spontaneous speech samples of each of the eighty children were recorded on tape during this period.

The experimental procedure entailed a nine-month program of speech therapy for the experimental group. The control group did not receive speech therapy during this period. The speech therapy program consisted of small groups, homogeneous as to speech defect, meeting once weekly for periods of forty-five minutes. Both groups continued regular classroom reading instruction.

At the conclusion of the nine-month experimental period, the children in both groups were re-tested in reading achievement by Form K of the Stanford Reading Achievement Test. The data obtained was analyzed to determine the extent and nature of the relationship between the basic variables of speech therapy and reading achievement.

The spontaneous speech of each of the eighty children was re-recorded. A panel of five trained speech experts listened to each of the eighty pre-experimental speech samples and rated them on a six-point scale of severity of speech defect. The ratings obtained were averaged to provide a value defining the severity of each child's speech defect. The recordings were then spliced into pairs to

enable the judges to evaluate the speech of each child before and after the experimental period. A measure of improvement was then obtained for each of the eighty children.

Comparison of the speech performances and the reading test results revealed a significant positive relationship between the reading ability and the speaking ability of speech defective children. The evidence indicated a significant relationship between severity of speech defect and retardation in reading. The more severe the speech defect — the greater the level of reading disability.

A highly significant relationship was found between reading improvement and speech improvement. Reading achievement of speech defective children showed significant improvement as a result of speech therapy.

Concerning the relationship between specific types of speech defects and the level of reading achievement, children with defects of lisping and lalling exhibited significantly higher average reading scores than children with defects of articulation and stuttering. The amount of reading improvement resulting from speech therapy, however, was not influenced by the type of speech defect. The improvement was comparable for each defect group.

This study has shown the marked relationship between reading achievement and speaking ability. It has established that the speech therapist indirectly implements the reading instruction given to speech defective children. It suggests that increased emphasis on the role of speech in the language arts curriculum warrants greater consideration.

Microfilm $2.00; Xerox $5.20. 102 pages.

A RHETORICAL ANALYSIS OF THE PUBLISHED SERMONS PREACHED BY JOHN WESLEY AT OXFORD UNIVERSITY

(L. C. Card No. Mic 59-3968)

Harold Vaughn Whited, Ph.D.
University of Michigan, 1959

If the preaching of John Wesley in the eighteenth century was as effective as many reports indicate, his sermons must be worthy of examination. The central purpose of this study is to add to the existing knowledge of Wesley's theology by analyzing a number of his sermons from the standpoint of his rhetorical practices. The selection of working samples is based mainly on his close and extended association with Oxford University.

The problem of the study is threefold: (1) to analyze five selected sermons according to rhetorical principles, (2) to summarize Wesley's theories and practices of delivery, and (3) to present helpful background and biographical data.

The first five chapters of the dissertation contain the analyses of the published sermons that Wesley preached at Oxford University from 1733 to 1744. First, the arrangement of the ideas of each sermon is treated generally, noteworthy traits of order are cited, a brief outline of the sermon is given, and the arrangement within the various parts of the sermon is discussed. Second, the invention of ideas is analyzed (1) by seeking the basic sources of Wesley's concepts through a study of his reading matter and activities, and (2) by citing the various modes of proof that are used: logical, pathetic, and ethical. Wesley's literary style is given perspective by a brief treatment of eighteenth-century English prose style and a review of his own stylistic theories and practices. The style of each sermon is classified, outstanding composition traits are cited, and the language used is examined.

Delivery is treated in chapter six, first, by tracing the origin of the ideas in Wesley's Directions Concerning Pronunciation and Gesture; and second, by discussing his main points of emphasis, voice and gesture. His personal appearance and characteristics are described, and his preaching is compared with that of his colleague George Whitefield.

The results of this analysis are both general and specific. Several qualities or rhetorical traits are noticeable in Wesley's university sermons: dialectics, fatalism, exposition, empirical reasoning, and criticism. The arrangement of ideas is classically simple, with some emotional appeals used in conclusion. Distribution of material is inconsistent, and is adapted to individual subjects and purposes. The ideas used in the sermons follow the central theme of salvation, and are not original; they mainly issue from Wesley's favorite religious authors and from Scripture. Quotations from more than two-thirds of the books of the Bible dominate the sermon texts. Most of these excerpts are from the New Testament, especially from the Paulian writings. All of the Aristotelian modes of proof are used in varying degrees. Logic is the appeal most used, and emotional appeals are increasingly employed as Wesley becomes personally involved with his subjects.

The literary style of Wesley's university sermons is essentially plain, simple, and precise. He particularly strives for clarity of meaning by careful word choice and lengthy explanation. Certain composition traits are common in the sermons, such as the use of connected series, rhetorical questions, and hypothetical figures. The strongest stylistic qualities in the sermons are description and exposition; pure embellishment is used only to support reason. Wesley was an example of his theories on delivery. He instructed his lay-preachers both personally and through his book on rhetoric. Most reports agree that his own manner of delivery was straightforward, forceful, and compelling. Microfilm $4.80; Xerox $16.00. 373 pages.

REPRODUCTIVE DEVELOPMENT IN THE WHITE LEGHORN PULLET

(L. C. Card No. Mic 59-3985)

Paul Stephen Alexander, Ph.D.
Indiana University, 1959

Anterior pituitary-gonadal relationships in White Leghorn chickens have been investigated by two different methods. The first, and major, phase of the study is concerned with maturation of the reproductive system of the pullet during the period of rapid sexual development which occurs at the approach of egg laying. The second phase involves an investigation of the gonadotrophin content of chicken blood.

In the first phase of the study, a total of 60 pullets from 80 to 155 days of age was autopsied in late Autumn at intervals of 5-20 days, and a total of 96 pullets from 123 to 162 days of age was autopsied during the Summer at intervals of 5-13 days. Body, comb, ovary, oviduct and anterior pituitary weights were recorded at autopsy. Pituitaries were stored in acetone. Pituitary gonadotrophic potency was determined by the stimulating effect of the glands on testis weights of chicks.

Age, comb size and body weight are inadequate indices of reproductive development in the pullet during the period of rapid maturation. The classification of 123 to 162-day-old pullets into 6 "maturation stages," based on the weights of the comb, oviduct and ovary taken at autopsy, makes it possible to characterize the developmental events during this period. Anterior pituitaries from these stages were assayed for their gonadotrophic potency, and changes in potency are correlated with the growth of the reproductive organs.

The pubescent period begins with an acceleration in the rate of comb growth at approximately 3 or 4 months of age and lasts 5-9 weeks before the onset of egg laying. Pauses in the growth of the body, ovary and pituitary are noted during the first half of pubescence. The marked increase in androgen secretion, as judged by comb growth, precedes a similar increase in estrogen secretion, as measured by oviducal growth. Furthermore, the output of both of these sexogens by the ovary increases greatly while the ovary exhibits a pause in its growth.

The gonadotrophic potency of the anterior pituitary increases during early pubescence, decreases markedly at midpubescence and remains low for more than a week. The pause in ovarian growth ends and follicular growth begins while the pituitary potency is low. A sharp rise in potency accompanies the subsequent rapid follicular growth, but a decline in pituitary potency follows the onset of laying. The above results are not in harmony with either the "teeter-totter" or "utilization" theories of pituitary-gonadal relationship and alternative explanations based on the hypothalamic control of pituitary gonadotrophic secretion are suggested.

In the second phase of the study, an attempt was made to demonstrate the presence of gonadotrophins in the blood plasma of immature or mature male and female chickens as well as capons. The injection of 5-10 ml. of fresh plasma or an acetone precipitate of 20-95 ml. of plasma into newly-hatched cockerels did not result in a significant increase in the weights of the testes. The use of the same acetone precipitation technique with plasma to which chicken pituitary tissue or pregnant mare serum gonadotrophin had been added yielded from one-third to one-half recovery of the gonadotrophin known to be present. It is concluded that either the blood level of gonadotrophins is very low in the chicken, or that the precipitation technique used is not suitable for recovering gonadotrophins from chicken blood.

Microfilm $2.00; Xerox $3.80. 69 pages.

A COMPARATIVE MORPHOLOGICAL STUDY OF THE AXILLARY REGION OF SOME PTERYGOTE INSECTS

(L. C. Card No. Mic 59-3831)

Richard Matthew Baranowski, Ph.D.
The University of Connecticut, 1959

Earlier studies of insect flight indicate that two physiological types are present. One, the synchronous type, exhibits the normal 1:1 response between stimulus and response. The second, the asynchronous type, does not show any relationship between stimulus and response in wingbeat frequency. In this group one stimulus can produce several wingbeats.

The axillary region of a selected series of insects was studied to determine whether the physiological types could be correlated with distinctive morphological features. The axillary sclerites and associated parts are described and the movements of the sclerites are discussed. Oscillograph records of several insects, representatives of various orders, were made in order to establish the physiological type to which they belonged.

Members of the Orthoptera, Mecoptera, Trichoptera and Lepidoptera were found to be of the synchronous type. Members of the Hemiptera and Hymenoptera were found to be asynchronous. Two families in the Homoptera, the Cicadidae and Cercopidae were synchronous and two families, the Membracidae and Cicadellidae were found to be asynchronous. The literature also reports that the Diptera and Coleoptera are asynchronous.

No special morphological mechanism was found to be present that could distinguish the two types. It appears that all of the insects examined have the external morphological structures capable of responding to the physiological action of the flight muscles found in the asynchronous group. The type of flight muscles in the insects does

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

appear to have a direct relationship with the physiological type of flight exhibited by an insect.

Microfilm $2.00; Xerox $4.60. 87 pages.

INTERSPECIFIC HETEROPLOID HYBRIDS IN THE CALIFORNIA NEWTS (TARICHA): A STUDY OF NUCLEAR AND CYTOPLASMIC FACTORS IN THE DEVELOPMENT OF LARVAL PIGMENT PATTERNS

(L. C. Card No. Mic 59-3684)

William Franklin Brandom, Ph.D.
Stanford University, 1959

Different experimental methods have been devised to test the role of the nucleus and cytoplasm in developmental processes (nuclear transplantation, hybridization, and heteroploidy). The results of these changes in quantitative and qualitative relations between the nucleus and the cytoplasm have aided in the formulation of concepts of the role played in development by these two major components of the cell.

This is a report of the results obtained when hybridization and heteroploidy are combined in a single experiment. By selecting parent species that differ strikingly in phenotypic characters, we are able to deduce the presumptive origin of additional or deleted chromosome sets by the dominant appearance of species characters in the "super-hybrid" progeny. This study also provided an opportunity to investigate gene-dosage effects of the combination of genomes differing in number and kind and aided in the study of the so-called karyo-plasma problem. The quantitative effects of heteroploidy on tissue and organ architecture were also studied.

The California newts, Taricha rivularis and T. torosa, develop larval pigment patterns that are strikingly different from one another. Virtually all of the melanophores of young torosa larva are confined to compact dorsal bands whereas in rivularis they are widely and uniformly distributed over the flanks. There are fewer larval melanophores in torosa than in rivularis. The number and arrangement of the chromatophores in the diploid hybrid is roughly intermediate between the parent species.

Diploid, triploid, tetraploid, and haploid hybrids were obtained from heat shock (35-37C for 10 minutes) on rivularis eggs fertilized by torosa sperm. The quantitative effects on the tissue and organ architecture of heteroploid hybrids were a progressive increase in nuclear and cell size (and a compensatory decrease in cell number) from the haploid to the tetraploid number of chromosomes. Changes in cell shape in single-layered tissues are discussed.

The triploid hybrids showed a much stronger phenotypic resemblance to the maternal species in the number and arrangement of the larval melanophores than did the diploid hybrids. The matroclinal shift in species characters was due to an interference with the normal extrusion of one set of maternal chromosomes in the second polar body. Triploid hybrids originating in this manner contain nuclei with two sets of rivularis chromosomes and one of torosa.

The tetraploid rivularis/torosa hybrid was intermediate between the parent species in larval pigment pattern. Presumably the haploid sperm and egg pronuclei formed a diploid hybrid nucleus. Then at the first cleavage division karyokinesis took place without cytokinesis; subsequent normal nuclear and cell cleavages would produce a tetraploid hybrid with a balance of rivularis and torosa species characters.

The haploid rivularis/torosa hybrids were dominantly torosa-like in species characters and were, accordingly, androgenetic in origin. These androgenetic haploids arose by the inactivation or destruction of the maternal chromosomes. The nucleus was the locus of the factors which determined the larval pigment pattern, and no evidence of cytoplasmic inheritance was observed.

Heat shock experiments were carried out on hybrids of rivularis egg and granulosa sperm, and triploid and tetraploid hybrids were obtained. The results are compared with those obtained in the heteroploid rivularis/torosa combination.

Microfilm $2.00; Xerox $4.60. 88 pages.

CHROMOSOMES OF AQUATIC PULMONATE SNAILS (BASOMMATOPHORA)*

(L. C. Card No. Mic 59-3914)

John Bayard Burch, Ph.D.
University of Michigan, 1959

Freshwater pulmonate snails (Basommatophora) are of considerable interest because of their wide distribution and variation, and because many are important vectors of human parasites. Cytogenetic and cytotaxonomic studies in this group are rare and for the most part unreliable. In this investigation the chromosomes of thirty-eight species and subspecies of aquatic pulmonate snails representing five families have been studied using some standard cytological techniques. Ovotestis material was sectioned and stained by the Feulgen reaction or crystal violet following fixation in the solution of Sanfelice; acetocarmine and acetic-orcein squashes were prepared following fixation in Newcomer's fluid. Duplicate shells have been deposited in the collections of the Museum of Zoology, University of Michigan, the U.S. National Museum, and the University of Colorado Museum.

The basic number of chromosomes for freshwater pulmonate snails appears to be eighteen pairs. This is the number found in Acella haldemani, Aplexa hypnorum, Armiger crista, Australorbis glabratus, Bulimnea megasoma, Detracia floridana, Fossaria modicella, F. parva, Gyraulus deflectus, Helisoma anceps, H. trivolvis, Lymnaea stagnalis jugularis, Melampus bidentatus lineatus, Physa anatina, P. gyrina, P. heterostropha, P. sayii crassa, Phytia myosotis marylandica, Promenetus exacuous, Pseudosuccinea columella, Stagnicola caperata, S. catascopium, S. emarginata angulata, S. emarginata serrata, S. exilis, S. lanceata, S. palustris, S. palustris desidiosa, S. palustris elodes, S. reflexa, and S. umbrosa. However, nineteen was the haploid number found in Fossaria modicella rustica and Planorbula crassilabris, and seventeen in Radix pereger, Ferrissia fusca, and F. tarda. Ferrissia parallela was found to have thirty pairs of chromosomes and Gyraulus circumstriatus to have

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

thirty-six. The latter is probably a tetraploid. Ferrissia parallela may also be a tetraploid, but this case is more doubtful since no ancylid with fifteen pairs of chromosomes has been found. Supernumerary chromosomes were found in one population of Gyraulus deflectus, and chromosomal bridges and fragments indicating structural heterozygosity were found during the first meiotic anaphase in another population.

Polyploidy and aneuploidy appear to be rare in basommatophoric snails and are probably not major factors in evolution of this group. Earlier indications of polyploidy (based on numbers reported for Physa gyrina and Melampus boholensis) are due to erroneous observations.

The mitotic chromosomes of species of Basommatophora are not oval or dot-shaped as previously described, but are elongate and monocentric. Therefore, the shapes of mitotic chromosomes cannot be used to distinguish this group from the land pulmonates (Stylommatophora), but may prove useful in discerning taxonomic relationships at lower systematic levels.

Any hypothesis concerning the origin of the Basommatophora must take into account its stability in chromosome numbers. Since the Stylommatophora differ from all other snail groups in that its species are characterized by greater number of chromosomes, it is difficult to visualize land pulmonates as ancestral to the freshwater lung-breathers, since the transition involves gain of chromosomes with land specialization and subsequent loss of chromosomes with adaptation to freshwater.

Microfilm $2.00; Xerox $5.00. 97 pages.

*This investigation was supported (in part) by a research grant, E-952, from the National Institute of Allergy and Infectious Diseases, Public Health Service.

VALIDITY OF AGE DETERMINATION FROM SCALES, AND GROWTH OF MARKED LAKE MICHIGAN LAKE TROUT

(L. C. Card No. Mic 59-3916)

Louella E. Cable, Ph.D.
University of Michigan, 1959

Scales of 1,603 lake trout, Salvelinus [=Cristivomer] namaycush, presumably recoveries from plantings of juveniles previously marked by clipping certain fins, were studied. Their characteristics are described and illustrated. Age readings from the scales are highly reliable. In addition to the annuli, an accessory mark designated the O mark, was found in the field of first-year growth. Annulus formation occurs over a period of several months.

Data presented show that most, probably all, of the 102 specimens caught in the southern part of Lake Michigan and a considerable number (86) of those captured in the northern part actually were from wild stock.

In general, the lake trout caught in large-mesh nets were larger fish than those taken in small-mesh nets. The fin-clipped lake trout caught in all nets were slightly larger than the wild stock of the same year classes, but wild lake trout of the earlier year classes, inhabitants of the lake before sea lampreys became numerous, were even larger and faster growing than the fin-clipped fish. The larger fish of the several year classes, caught in nets of either mesh-size, were taken from the northern part of Lake Michigan and smaller fish from the southern part of the lake. Microfilm $2.45; Xerox $8.60. 186 pages.

STUDIES OF MOSQUITO BREEDING IN NATURAL AND IMPOUNDED SALT-MARSH AREAS IN NEW JERSEY

(L. C. Card No. Mic 59-3570)

Harold Clyde Chapman, Ph.D.
Rutgers University, 1959

In 1953, a three-year study was undertaken in New Jersey to determine the mosquito-breeding potential of six impoundments and four normal salt-marsh areas. Rainfall was above normal in 1953, much below in 1954, and about normal in 1955.

Larval investigations showed the impoundments always produced more Culex and Anopheles but fewer Aedes than salt-marsh areas. Breeding of Culex and Anopheles showed a decreasing trend from one year to another in all plots; Aedes increased. The flooded impoundment always produced much fewer Aedes, more Anopheles, and in two of the three years, fewer Culex than those drawn-down. Heaviest breeding occurred at water depths of 5 to 10 inches below meadow level for Aedes, slightly below meadow level for Culex, and at 5 to 10 inches above meadow level for Anopheles.

In the impoundments, cattail always produced the largest numbers of Culex, principally salinarius. Anopheles, chiefly crucians, were most numerous in ditches in two of the years and in cattail the other. Lesser numbers of Anopheles, mostly bradleyi, were dipped from bare areas and soft stem bulrush. The prevalence of Aedes depended more upon the amount of water present than the type of vegetation. In the salt-marsh, stations erected in a mixture of salt-marsh cord grass and salt-meadow cord grass produced the highest numbers of all three genera. Aedes breeding was observed in 46 of the 56 times these areas were checked. Aedes sollicitans, A. cantator, Anopheles bradleyi, and Culex salinarius were the dominant species.

The common species varied in prevalence in the impoundments as the rainfall and water levels increased and decreased.

Heavy breeding of Mansonia perturbans may occur in impoundments containing cattail that remain flooded for a year or more. The summer draw-down practice reduced or eliminated this species.

Culex adults (chiefly salinarius) were generally the most numerous in light trap collections. They represented about 57 percent of the adult females trapped in 1953, 20 percent in 1954, 45 percent in 1955, and 57 percent in 1956. Anopheles were more prevalent than Aedes in 1953, 1954, and 1956, comprising 34, 51, and 22 respectively of the total, but dropped to only 6 percent in 1955. Aedes, chiefly sollicitans, constituted 8, 17, and 23 percent of the collections in 1953, 1956, and 1954, then increased to 49 percent in 1955. The large numbers of Aedes caught in 1955 were attributed to above normal temperatures at dusk rather than to increased breeding.

Excellent reductions of Culex, Aedes and total larvae were obtained from dipping within dynamited potholes or ditches. Lesser reductions were evident in dipping adjacent to the dynamited areas. The low larval populations in 1955 made it difficult to evaluate the effect of dynamited ditches and potholes on Anopheles breeding.

A total of 24 species of mosquitoes were identified during the study with eighteen species collected as larvae from the observation areas and 22 species identified as adults from the light trap collections.

High salinities appeared to be no barrier to mosquito breeding or to certain predators since Aedes sollicitans was found in water with a 137.0 reading and minnows in water with a reading of 109.4 percent of that of sea water.

Since Aedes sollicitans is the outstanding daytime biter in the area, all efforts should be directed toward reducing its breeding in the impoundments. The impoundments, originally salt-marsh, reduced breeding of Aedes sollicitans 95 percent in 1953, 65 percent in 1954, and 75 percent in 1955. Much higher populations of Culex and Anopheles were produced by the impoundments, but these genera cause relatively little annoyance.

During the three years, utilization of the impoundments by wildfowl, muskrats, and fish showed a general increase.

Microfilm $2.05; Xerox $7.40. 156 pages.

WAVES AND PATTERNS OF HAIR GROWTH IN THE MOUSE

(L. C. Card No. Mic 59-4337)

Gordon Joseph Eaton, Ph.D.
Brown University, 1959

Hair growth waves and patterns in the mouse provide excellent material for the study of mechanisms and controls of growth. The first hair growth generation is embryonic, and it consequently differs in pattern and spread from the second hair generation. At the beginning of this generation (G II), hair growth invariably appears on either the throat-whorls, the loin regions or on both simultaneously. Waves of hair growth from these four loci spread and cover the venter. In the following generations of hair growth (G III, G IV, and G V) waves of growth start similarly, but their direction and rate of progress varies from generation to generation. In the healthy mouse the G II hair growth waves spread rapidly on the venter and dorsum; for this reason the four loci of initiation of hair growth are often obscured.

In hair generation III two waves cover the venter: an anterior to posterior wave starting at the throat region and a posterior to anterior wave starting at the loin regions. The velocity of these waves is sufficiently slow to allow daily measurements of their progress. Hair growth waves on the main dorsum move in a posterior to anterior direction in the majority of animals, a direction exactly opposite to the pattern observed for G II. This reversal of pattern occurred in 80 per cent of C57 Brown males and females, but 16 per cent displayed a dorsum pattern involving two waves: one starting on the anterior saddle and moving posteriorly, and another moving anteriorly from the sacrum at about the same time. Furthermore, the latter pattern of two waves is the most common (70 per cent) for C57 Black mice, which display a total of five patterns. The G III wave of C_3H mice is similar to that of C57 Black but without the second anteriorly moving wave.

The venter pattern of hair generation IV is similar to G III, but the dorsum pattern is anterior to posterior as in G II. Moreover, the anterior to posterior G IV wave on the dorsum begins with eruption of hairs on the anterior saddle region. This area acts as a center of activity, and a wave spreads slowly in a centrifugal pattern, primarily in a latero-posterior direction. The spread of the wave is considerably slower than in G III; consequently, hairs are fully grown on the anterior saddle before the wave covers the entire saddle region.

Generation V is the last phase of hair growth described in this report. In females G V wave patterns are essentially like those in G IV except that waves proceed more slowly. Without exception, the anterior saddle is one of the first regions to grow. In males hair growth waves are irregular and occur within small islands. The skin around these islands of growth may remain resting for long periods of time.

It is conceivable that the skin of the mouse is a mosaic. The mosaic character is expressed by the differential reaction of hair follicles in different regions to growth waves. Depending upon their locations, discrete populations of hair follicles may participate in a hair growth wave or contrariwise fail to become involved and consequently lag behind adjacent populations of active follicles. The constant appearance and location of lag or refractory areas has been alluded to in the description of the various generations of hair growth. The main chest, main vertex of the head, collar, and the base of the tail constitute the refractory regions of the skin of the mouse.

Plucking club hairs from skin of refractory regions, non-refractory regions, and regions of skin where waves are initiated from G III onward reveals a regional differentiation of venter and dorsum skin. The results of the plucking experiment show that a certain number of club hairs must be plucked from the designated regions of the skin to induce hair growth. In general, the size of the area necessary to elicit hair growth differs among lag, non-lag regions and regions of wave initiation. The degree of refractoriness (measured in days) to the plucking stimulus in lag regions increases as the area decreases, while such an inverse relationship apparently does not hold for non-lag regions.

There are two hypotheses to explain hair growth: the inhibitory hypothesis and the stimulatory hypothesis. In view of the evidence reported in this paper for both induced and spontaneous hair growth, it appears at present that both the hair growth inhibitory hypothesis and the hair growth stimulatory hypothesis are adequate as explanations for initiation and cessation of hair growth cycles and waves. Incontrovertible proof for both hypotheses is lacking and will be supplied only by the isolation of these substances from the skin. Regardless of how one attempts to explain initiation and propagation of hair growth cycles and waves, either by stimulatory or inhibitory substances, these phenomena must be considered as mirroring numerous, complex interactions on the cellular, tissue, and organismic levels of organization.

Microfilm $2.00; Xerox $3.60. 62 pages.

THE PLANKTON BIOLOGY OF RARITAN BAY

(L. C. Card No. Mic 59-3582)

Harry Perry Jeffries, Ph.D.
Rutgers University, 1959

Major Professor: Dr. Harold H. Haskin

The hydrography, phytoplankton, and zooplankton of Raritan Bay were investigated from June 12, 1957, to September 11, 1958, to (1) characterize the dynamics of plankton populations in a heavily polluted, well-fertilized estuary, and (2) observe changes in plankton and associated physical-chemical factors following operation of a trunk sewer. Zooplankton samples taken concurrently during 1958 in Narragansett Bay and the York River were compared with Raritan Bay.

A combination of rich nutrient sources emanating from the Raritan River and discharged waste materials, scarcity of attached macroscopic algae, sluggish circulation of bay waters, and an efficient mechanism of nutrient regeneration form ideal ecological conditions for the dominant summer phytoplankter, Nannochloris atomus. Primary gross productivity during the summer of 1957 exceeded by ten times values that have been reported for near-by areas. The photosynthetic compensation point appears to be located at a depth of approximately five feet.

Acartia clausii, a winter copepod, and A. tonsa, a summer form, alternate cycles of abundance so that one or both species are present year-round. Equivalent numbers of clausii and tonsa nauplii occurred in Raritan Bay, the York River, and probably Narragansett Bay when water temperatures warmed to approximately 18°C. Temperature appears to be the primary factor keeping the overlapping niches of the two species separate during the remainder of the year. In summers with high river flow, a bilateral separation of water masses occurs downbay which is reflected by regional differences in the dates successive generations of tonsa mature. A. clausii may be inhibited by large concentrations of neritic diatoms. It is suggested that 4°C is near the lower limit of temperature tolerance for this species. Adults responded with approximately equivalent rates of fecundity throughout Raritan Bay. Failure of a sizable population to develop in the head of the bay is attributed to non-tidal drift carrying developmental stages oceanward.

Eurytemora americana initiated propagation near the mouth of the Raritan River during winter and was followed by E. hirundoides augmentation. Consecutively later disappearances of americana from the river to the mouth of the bay suggested a species interaction. Distribution of Eurytemora along the axes of six estuaries or segments thereof indicated that when more than one-third of the length lies within the salinity bracket 5 to 15, Eurytemora is the dominant spring copepod throughout most of the embayment.

Temporal and spatial distributions of eight adventitious offshore copepod species in Raritan Bay reflected the pattern of circulation. In relation to duration off the New Jersey coast, boreal immigrant species were present for a greater proportion of the period than southern migrants.

During summer months, considerably greater densities of copepods, fish eggs, rotifers, and larvae of benthonic invertebrates occurred in 1958 than the previous year. Following operation of the trunk sewer, regional abundances of several groups may have been associated with alleviation of pollution in the Raritan River.

A characteristic of the benthos is paucity of decapod species. Occurrences of Malacostraca larvae, Coelenterata, Chaetognatha, and immature Chordata in the three estuaries sampled are presented.

Microfilm $2.55; Xerox $9.00. 196 pages.

STUDIES ON THE ROLE OF PHORMIA REGINA (MEIGEN) AS A VECTOR OF CERTAIN ENTERIC BACTERIA

(L. C. Card No. Mic 59-3874)

Joseph Lewis Knuckles, Ph.D.
The University of Connecticut, 1959

Studies have been made on the role of Phormia regina (Meigen) as a vector of Salmonella schottmuelleri (Winslow, Kligler and Rothberg) and Salmonella typhimurium (Loeffler). The purposes of these studies have been to determine whether: (1) S. schöttmuelleri and S. typhimurium can multiply in P. regina; (2) a sucrose-human fecal filtrate affects the multiplication of S. schöttmuelleri in Phormia; (3) attenuating S. typhimurium has an affect upon its multiplying ability in blowflies; (4) S. typhimurium and Proteus morganii Morgan can coexist in P. regina when fed in equal concentrations; (5) a threshold number of S. schöttmuelleri is required for its establishment and multiplication in blowflies; (6) the residual number of S. schöttmuelleri in P. regina following a morning feed-defecation period is sufficient for the species' persistence in Phormia; (7) S. schöttmuelleri multiplies in the crop or other parts of the digestive tract; (8) S. schöttmuelleri and S. typhimurium can be transmitted from fly to fly via infectious feces; (9) S. schöttmuelleri and S. typhimurium can be transferred from infected larvae to blowfly pupae and imagines and if so, the length of time they may persist in them.

New techniques and apparatuses have been employed in conjunction with these studies. They have involved aseptically-reared blowflies that were fed known number of pathogen, previously sterile blowflies infected by ingesting infectious fly feces and pupae and non-bacteria fed blowflies reared from Salmonella infected instars. Standard bacteriological methods were employed to ascertain the presence or absence and/or number of a bacterium in fly fecal, gut and pupal samples.

The following conclusions have been made. A threshold of from 13,750-15,000 S. schöttmuelleri is required for its establishment and multiplication in the blowfly. The number of residual S. schöttmuelleri in P. regina following a morning feed-defecation period is sufficient to facilitate indefinite bacterial multiplication. Enteric microbes are likely able to multiply throughout the digestive tract of P. regina, but their greatest multiplication occurs in the crop. Salmonella schöttmuelleri and S. typhimurium are capable of multiplying from twenty to forty times a day in sterile flies fed a single bacterial meal and routine feedings of sterile 0.5 molar sucrose. These pathogens may multiply in vivo throughout the blowfly's life. The diurnal

multiplication of the former species is from two to three times greater in blowflies fed a sterile sucrose-human fecal filtrate diet than in flies fed only sterile 0.5 molar sucrose. A recently isolated strain of S. typhimurium demonstrated a static ability to multiply in blowflies fed a single bacterial meal and routine feedings of sterile 0.5 molar sucrose before and after it had been attenuated for nine months. This pathogen and P. morganii were not detected in sterile flies fed equal numbers of these species and 0.5 molar sucrose. Bacteriophage or bacterial competition reduced each species to a number which was less than that required for their survival in P. regina. Salmonella typhimurium multiplied in Phormia when fed to sterile flies retained under similar conditions during a previous study. The ability of this pathogen to persist in flies which have been infected with it and P. morganii probably rests upon a larger number of the former being ingested in the initial infection than P. morganii.

Non-infected P. regina may become infected with S. typhimurium and S. schöttmuelleri by ingesting infectious fly feces and serve as vectors of these pathogens. Blowfly sexes show no significant difference in these respects and in all determinations indicated in this paper.

Salmonella schöttmuelleri may be transferred from instars infected with this species and non-pathogens to all developmental stages of the blowfly. Salmonella typhimurium may be transferred from larvae infected with typhimurium to fifth-day pupae but was not demonstrated to have been transferred from infected larvae to and in pupae from one to five days old or to imagines when larvae also fed on medium contaminants. Metamorphosis causes a more rapid decrement in the number of S. schöttmuelleri transferred from infected larvae to and in pupae from one to four days old than during the conversion of last-day pupae to imagines. Proteus and Aerobacter sp. offer a degree of inhibition upon the persistence and/or multiplication of S. schöttmuelleri and typhimurium in the developmental stages of Phormia but to a greater extent toward the latter. Salmonella typhimurium does not appear to be as tolerant as schöttmuelleri toward bacterial competition. Proteus and Aerobacter sp. possess a greater ability to resist bacterial competition and fly metamorphosis than the pathogens used.

Microfilm $2.00; Xerox $6.80. 142 pages.

STUDIES ON THE DEVELOPMENTAL BIOLOGY OF CRASPEDACUSTA

(L. C. Card No. Mic 59-4018)

Charles Franklin Lytle, Ph.D.
Indiana University, 1959

Major Professor: Sears Crowell

Reproduction and morphogenesis were studied in the polyp stage of the freshwater medus Craspedacusta sowerbii using a technique developed for the culture of isolated polyp colonies. Morphological studies on living animals led to the redescription of the normal budding processes exhibited by these polyps and the establishment of a series of normal stages for each type of budding.

These polyps produce three types of bud: hydranth buds which normally remain attached to the parent to form small colonies; frustule or planuloid buds which separate and creep a short distance before growing into new polyps; and medusa buds which are released as free-swimming medusae. Colonies were reared at three different temperatures and at various rates of feeding to study the influence of these two factors on growth and reproduction.

Temperature experiments (20 ± 1° C, 19-23° C, and 27 ± 2° C) revealed that the budding processes are largely separated into a sequence of distinct phases: an initial phase of rapid growth, a phase of rapid frustule production, and a phase of medusa budding. Some evidence was obtained that these phases are recurrent, as has been demonstrated in several species of hydra.

The same basic pattern of growth and reproduction was observed at all temperatures employed, but certain variations on this common pattern were noted at different temperatures. Among the variations were significant differences in the time of appearance of medusa buds and in the size attained by the colonies after a given time. At 19-23° C the initial growth phase was prolonged, leading to the formation of large colonies (up to 24 hydranths), and the initiation of medusa budding was delayed. At 27 ± 2° C and 20 ± 1° C the initial growth phase was shortened and much smaller colonies were formed; these colonies formed medusa buds 17-25 days earlier.

Further analysis of the growth and reproduction of colonies at different temperatures indicated that hydranth budding (colonial growth) limits medusa budding, and that medusa budding limits frustule production (asexual reproduction). The relationship between hydranth budding and frustule production is less clear, but there is some suggestion that a similar relationship may exist here also.

Nutrition experiments demonstrated that the budding processes are affected differently by increased rates of feeding. At very low levels of feeding, medusa budding may be eliminated and the colonies remain small with few frustules being formed. At intermediate rates, a large portion of the nutritive substances is utilized in colonial growth and in medusa budding. At high levels, however, the largest portion of the food materials is utilized in the formation of frustules, and proportionally less goes into the production of new hydranths and medusa buds. These experiments provide evidence that the interactions between growth, frustule production, and medusa budding are based partly upon physiological competition for nutritive substances.

Other evidence, however, indicates that in addition to this competition there is a series of changes in the physiological state of the colony. These physiological changes are believed to involve a system of alternate pathways for the utilization of nutritive substances with the selection of pathways regulated by the specific physiological condition of the colony. Microfilm $2.00; Xerox $6.60. 137 pages.

THE POPULATION DYNAMICS OF UNCONFINED POPULATIONS OF THE HOUSE MOUSE (MUS MUSCULUS L.) IN MINNESOTA

(L. C. Card No. Mic 59-3757)

Charles Franklyn MacLeod, Ph.D.
University of Minnesota, 1959

Adviser: James R. Beer

House mouse (Mus musculus L.) populations in a poultry barn near Rosemount, Minnesota, were followed by the use of live traps for two summers. Supplemental information was gathered using snap traps in the fields surrounding the barn and in a group of buildings in the Red River Valley near Moorhead, Minnesota. Population estimates based on the number of mice known to be alive in the barn were found to be more reliable than those based on the Lincoln Index. Where snap traps were used the number of mice captured per unit of trapping effort indication population trends.

The mice in the southern and northern ends of the barn were treated as separate populations because there was a minimum of movement from one end to the other, and because the two groups of mice behaved differently. The removal of food and cover from the south end in the spring resulted in a gradual decline in numbers which continued through the summer. In the north end the population increased to a maximum, levelled off, then crashed following the removal of food and cover in the fall. Disappearance rates were higher for the males than for the females particularly for the adults in the dense population of the north end. Reproduction, as revealed by the capture of juveniles in the traps, continued at all population levels. The house mouse was found to be very mobile (distances up to 0.9 mile recorded) and emigration from the barn was frequently recorded. Within the barn, however, movements were restricted, with those in the dense population significantly shorter than those in the declining population. It was concluded that fighting-induced emigration was the most important factor regulating the composition of the population of the north end of the barn. In the south end food and cover were more important.

In the fields house mice were captured in all months of the year except January. Populations were low in the winter, increased to a maximum in September, then declined rapidly. The buildings in the Red River Valley also revealed a winter low and late summer high. The sex ratios in these environments were different from those in the poultry barn in that the males outnumbered the females in the summer. This was probably due to an interplay between building and field populations. Reproduction continued throughout the year in these buildings even when the temperature dropped to 25° F. below zero (-31.6° C.) but the survival of young under these conditions was low.

In the poultry barn at Rosemount, sanitation and poison were effective in eliminating the mice for a short period of time. Such attempts at control in an individual building have no long-term effect, however. The high field populations and the great mobility of the house mouse make reinvasion inevitable.

Microfilm $2.00; Xerox $6.20. 130 pages.

DAILY RHYTHMS IN HARVESTER (VEROMESSOR ANDREI) AND ARGENTINE (IRIDOMYRMEX HUMILIS) ANTS

(L. C. Card No. Mic 59-3710)

Elwood Sturges McCluskey, Ph.D.
Stanford University, 1959

Daily rhythms have been observed in a great variety of animals, plants, and microorganisms. Such diurnal periodicity is now known in many cases to be endogenous, as indicated by persistence in constant temperature and darkness; the organism then manifests its own "natural period," close to, but different from, 24 hours. Further, the "phase" of the rhythm can be established, or altered, by a single, non-24-hour exposure to light. One of the most striking manifestations of an internal "clock" is time-compensated sun navigation; birds and certain arthropods, including honeybees and at least one ant, can maintain a given direction by continually changing their angle of orientation to the sun, exactly compensating for its motion.

Nuptial flights of various ants occur at species-characteristic times of the day. And workers of some species are active during only a certain part of each 24 hours. These rhythms seem to have been little analyzed under controlled conditions, though the possible role of rhythms or clocks in ant social organization should add interest to such research. In the study here reported, two widely-different species of ants were placed in a constant-temperature room, and hourly activity counts made either by eye or with a capacity-operated relay.

In alternating light and dark the males exhibited a sharp daily peak. The harvester activity rose during the last hour of the dark, reaching a peak the first part of the light period, whereas the Argentines were active during the last hours of the light period. The increase in activity before the changes in lighting, suggest endogenous control of the rhythms. Further evidences for such an internal clock in both species were (1) persistence of rhythm in constant darkness (i.e., red light), though the harvester peak averaged a half to one hour later each day; and (2) a shift of phase following exposure to a single light period. Neither harvester females nor Argentine workers exhibited a marked rhythm when studied in alternating light and dark at the same time as the males.

Harvester mating flights occur locally early in the morning, as might be suggested by the time of the laboratory peaks of the male activity. A species-characteristic light-phase relationship would seem valuable in synchronizing the nuptial flights of colonies of the same species. And endogenous control could bring the ants to the surface in time for the dawn; an exogenous light cue might go unperceived underground. The value of the clock-like activity of Argentine males is more difficult to explain, since mating takes place within the nest.

Thus at least the males of these two species, representing different subfamilies of ants, manifest a clock similar to that found in other organisms. And there is a suggestion of the value of such a mechanism in facilitating cross-breeding.

Microfilm $2.35; Xerox $8.20. 178 pages.

DIFFERENTIATION OF EARLY CHICK EMBRYONIC TISSUES PRETREATED IN NON-NUTRIENT SALINE

(L. C. Card No. Mic 59-3759)

Robert Gilmore McKinnell, Ph.D.
University of Minnesota, 1959

There are many reports in the literature which provide evidence that cells and tissues, when isolated in various sorts of saline solutions, will lose proteins and other organic materials to their environment. One may ask the question does the loss of cellular material that occurs during isolation in vitro affect the biological characteristics of embryonic cells? The capacity to undergo differentiation was a characteristic chosen for study of chick embryonic tissue which had been treated in such a manner that loss of large organic molecules was likely to occur.

Small fragments of definitive primitive streak blastoderms containing Hensen's node were isolated and incubated at 37.5° C. in a simple physiological saline solution. The effect of such pretreatment on the capacity for differentiation was tested by grafting the pretreated tissue to the chorio-allantoic membrane of host embryos. Pretreatment was varied by the use of large volumes of saline (5 to 10 ml.) versus small volumes of saline (ca. 0.02 ml.) as well as the presence or absence of glucose in the medium.

Embryonic tissue isolated in a non-nutrient saline for 26 hours or less retains its normal differentiative capacity as expressed in chorio-allantoic grafts. Under the conditions of this study, isolation for 30 or more hours destroys the tissue's ability to grow on the membrane. Incubation for intermediate periods of time (27½ hours) in saline results in a change in histogenic potency. Grafts of 27½ hour pretreated tissue contain neither notochord nor differentiation characteristic of the different levels of the central nervous system. Neural ganglia, pigment epithelium and skeletal muscle also fail to differentiate. Varying the volume of saline and the presence or absence of glucose did not dramatically affect differentiative capacity.

The non-nutrient saline used for pretreatment, after centrifugation to remove free cells, gave positive ninhydrin, biuret, and orcinol tests. Ultraviolet absorption of the solution showed a peak at 265 millimicrons with some absorption between 280 and 300 millimicrons. There was a steep rise in absorption at wave lengths shorter than 240 millimicrons. These tests indicate that protein, ribonucleoprotein, RNA, or their derivatives are found in the isolation medium.

Electron micrographs of treated node tissue were compared with electron micrographs of normal, untreated node tissue. Cell organelles and yolk granules of several categories were identifiable in both treated and untreated tissue. Although the tissue undergoes no visible differentiation while isolated and incubated for prolonged periods in saline, it retains a considerable capacity for differentiation when transferred to a more optimal physiological environment (the chorio-allantoic membrane). Its histogenic stability while in saline cannot be due to the utilization of formed yolk granules.

Changes in differentiative capacity which occur with 27½ hours of incubation in vitro are discussed in light of the cytology and histology of the pretreated tissue. The source of the organic material found in the saline after pretreatment and the effect of the loss of this material on differentiative capacity are discussed.

Microfilm $2.00; Xerox $4.00. 73 pages.

A COMPARATIVE STUDY OF CERTAIN ASPECTS OF THE ANATOMY OF THE ANHINGA, ANHINGA ANHINGA LEUCOGASTER (VIEILLOT), AND THE CORMORANT, PHALACROCORAX AURITUS FLORIDANUS (AUDUBON), WITH REFERENCE TO THEIR ECOLOGY

(L. C. Card No. Mic 59-3951)

Oscar Theodore Owre, Ph.D.
University of Michigan, 1959

This study is a comparison of aspects of the morphology, chiefly myology and osteology, of the Anhinga, Anhinga anhinga leucogaster (Vieillot), and the cormorant, Phalacrocorax auritus floridanus (Audubon). Field observations of behavior and ecology supplement anatomical comparisons.

Wing loadings were determined from four males and four females of each species. Two males and two females of each were used in dissections of the muscles of the wing, tail, leg and head. Individual muscles are described, their volumes and actions are given, and comparisons are made between the two species. Additional specimens were used in skeletal comparisons.

Although the Anhinga is aquatic it exhibits greater adaptations for an arboreal habitat than the cormorant. Lighter wing loading, longer primaries, more extensive wing slots, a larger pectoral muscle, and its ability to climb from the water up into vegetation enable it to frequent small, forest-enclosed ponds from which the cormorant could not take off. The characteristic flap-gliding and soaring flight of the Anhinga, which is not exhibited by the cormorant, is made possible by additional wing modifications and by its tail, which is more than twice the size of the cormorant's.

The comparatively less robust caudal vertebrae of the Anhinga, which are of greater total length in comparison with the synsacrum than those of the cormorant, are capable of more intricate positioning and have force exerted upon them from more lateral points. More powerful, but more unidirectional depression of the tail is possible in the cormorant.

When flightless during molt, the Anhinga becomes shy and alert. Corrugations of its rectrices are probably functional, through reflection of light, with other releasing mechanisms during courtship. Wing and tail feathers are not ordinarily used by the Anhinga for steering and propulsion in swimming as they probably are in the cormorant. The fanned tail and semi-flexed wings of the Anhinga may function to impede sinking and forward progress during submergence.

Proportions of the leg elements and the synsacrum and development of muscles important in swimming indicate greater aquatic adaptation of the cormorant. The proportions of the leg elements and the synsacrum and the development of muscles important in non-aquatic progression, as well as the morphology of the foot, point to a greater degree of adaptation for perching in the Anhinga.

More pronounced differences are found in the morphology of the skull than in that of the appendages. Extensive mandibular adductors and modifications of areas of the skull from which these originate characterize the head of the cormorant. The latter seizes prey between its mandibles. These features are not as pronounced in the Anhinga,

which impales fish upon its mandibles. In the latter, elevators important in raising the head to a position for carrying impaled fish are better developed. Depressors and rotators of the head are larger and more effective in the cormorant.

The Anhinga usually stalks its prey; the cormorant pursues it or searches the bottom for it. In south Florida slow-moving fish comprise the bulk of the Anhinga's diet. It is unable to impale thick-bodied fish or fish with thick scales, which the cormorant easily seizes. Where the two species may fish the same body of water, they are not direct competitors.

Conclusions as to phylogenetic relationships between the two species are not made, but attention is called to differences in proportions of the intramembranal elements of the wing and leg. Need for investigation of the embryological development of the patella, occipital style, and mandibles is pointed out.

Microfilm $4.70; Xerox $15.60. 365 pages.

THE SERUM PROTEINS OF ANIMALS INFECTED WITH LEISHMANIA DONOVANI, WITH SPECIAL REFERENCE TO ELECTROPHORETIC PATTERNS

(L. C. Card No. Mic 59-3596)

Richard Norman Rossan, Ph.D.
Rutgers University, 1959

Major Professor: Leslie A. Stauber

The serum protein patterns, for eight species of animals inoculated with the Khartoum strain of Leishmania donovani, were obtained by paper electrophoresis. Approximately 750 serum patterns of uninfected animals, and animals at various stages during infection and superinfection were analyzed.

In cotton rat, golden hamster, Chinese hamster, chinchilla, mouse, and Mongolian gerbil, animals susceptible to infection with this strain of the parasite, modifications of the serum fractions were observed. However, those animals (guinea pig and rabbit) which apparently are poor hosts for the parasite, gave evidence of little or no alteration of their serum components.

The observed changes of the serum fractions, in the susceptible animals, could be correlated with the duration of the infection, the number of parasites originally inoculated, and the route of parasite inoculation. A common finding, among the susceptible animals, was some degree of albumin depression with a concomitant increase of gamma globulin concentration. Although the concentrations of alpha and beta globulins, and total protein were variable during the course of the infection, there was an indication of increased amounts of these components.

Detailed analyses of the gamma globulin area, on the electrophoretic patterns of the infected animals, revealed that slow-moving gamma globulins were formed in the cotton rat, golden hamster, and Chinese hamster, species which are highly susceptible to infection with L. donovani.

A limited serological study of infected gerbil sera indicated that agglutinins, to suspensions of Leishman-Donovan bodies, were formed during the course of infection. Adsorption of these sera, with the parasite antigen, reduced both the titer of the serum sample and the amount of gamma globulin, as shown by electrophoretic patterns. Although there appeared to be a direct relationship between the antibody titer of the unadsorbed serum and the degree of titer decrease after adsorption, there was no evident correlation between the titer of these sera and the amount of gamma globulin observed before and after adsorption.

(This investigation was supported by a research grant, E-92, from the National Institute of Allergy and Infectious Disease, Public Health Service.)

Microfilm $2.85; Xerox $9.80. 218 pages.

STUDIES ON THE ANATOMY AND LIFE HISTORY OF THE GEM CLAM GEMMA GEMMA (TOTTEN)

(L. C. Card No. Mic 59-3599)

George P. Sellmer, Ph.D.
Rutgers University, 1959

Major Professor: Dr. Leslie A. Stauber

A comprehensive study of the gem clam, Gemma gemma was made at Union Beach, New Jersey during the period 1955-1958 which included anatomy, growth, reproduction, population density, mortality, parasites and predators.

The gem clam is ovoviviparous, carrying its embryos in the demibranchs. It has a maximum length of 5 mm and is found in sandy situations in intertidal and subtidal estuarine areas.

The distribution of Gemma is from Labrador to Texas and has been introduced to the west coast where it ranges from Puget Sound to San Diego. It has no veliger stage, and dispersal, particularly of the juveniles, is probably accomplished through current and wave action.

A description of the entire anatomy is given with special attention being paid to two membranes inside the base of each siphon. The incurrent siphon membrane may be lowered to deflect silt-laden water away from the gills. The excurrent siphon membrane has not been previously described in detail in other clams. It possesses a vertical ovoid slot which may possibly be able to be completely closed. It is speculated that this membrane may (1) assist in withdrawal of the sleeve-like extension of the excurrent siphon, (2) slow or stop water movement through the clam thus aiding cleansing actions, (3) prevent loss of gametes during ovulation and (4) aid in liberation of juveniles.

Growth of 5 year classes was studied from monthly or semimonthly samples of the same population. Juveniles liberated in summer average approximately 375 μ in length. They attain a length of about 2 mm when growth ceases in the fall, and reach adult size the following summer when they attain an average length of 4 mm. The growing period begins in April and ends, at the latest, in November.

Terms ordinarily used to describe brood protection are analyzed and factors associated with this condition are discussed. A list of some 75 species of brood-protecting

clams is given with notes on various aspects of their reproduction.

In vitro experiments indicate that embryos of Gemma can be cultured outside the mother during at least the latter half of their developmental period, and raised to maturity.

Embryos may be found in the demibranchs at all times of the year. Some females attain sexual maturity at 4 months, but the majority mature at one year and liberate 100-200 juveniles during the summer with greatest numbers being released in July.

During the summer, population density may reach 200,000 or more per square meter. A decline in numbers was observed during the study. Biomass (wet weight including shell) showed seasonal fluctuations varying between 2 and 200 grams per square meter.

A life table was prepared and survivorship and mortality rate curves plotted from it. The maximum life span of Gemma at Union Beach is 2 years, but the mean life span is only 1.13 months. Mortality rate averages approximately 40% per month.

Predators of the gem clam thus far reported or discovered during this study include a sea anemone, a gastropod, 5 species of crabs and the horseshoe crab and 18 species of shore birds, half of them ducks.

Metacercariae of Parvatrema borealis were found between shell and mantle of most gem clams. Sporocysts of probably the same species are found in the gonads of about 1% of these clams. Sporocysts of Cercaria adranocerca similarly infect the gem clam. An unidentified metacercaria was also found.

Gemma has both positive and negative value to man. It forms a part of the diet of game ducks and probably acts as a buffer species against predators of commercial species of clams. It is believed to maintain populations of predatory gastropods during a dearth of economically important clams and acts as host to trematodes which may infect, as adults, animals important to man.

Microfilm $3.15; Xerox $10.80. 243 pages.

THE LEAFHOPPERS OF MICHIGAN EXCLUDING THE SUBFAMILIES ATHYSANINAE AND CICADELLINAE (HOMOPTERA, CICADELLIDAE)

(L. C. Card No. Mic 59-2649)

Oscar Taboada, Ph.D.
Michigan State University, 1957

This work is a faunistic study of the family Cicadellidae or leafhoppers of Michigan, excluding the subfamilies Athysaninae and Cicadellinae. Keys for the identification of 87 species in the subfamilies, Tettigoniellinae, Evacanthinae, Penthemiinae, Jassinae, Dorydiinae, Ledrinae, Xestocephalinae, Aphrodinae, Eurymelinae, Macropsinae, Agallinae, Gyponinae and Bythoscopinae are included. Brief descriptions of the higher groups and of each species are given, with notations on the available taxonomic information, known hosts, economic importance and distribution in the United States with particular emphasis on Michigan.

Microfilm $2.30; Xerox $8.00. 173 pages.

THE SPATIAL AND TEMPORAL DISTRIBUTIONS OF PLETHODON C. CINEREUS AND EURYCEA B. BISLINEATA

(L. C. Card No. Mic 59-3606)

Frieda Blou Taub, Ph.D.
Rutgers University, 1959

Major Professor: Dr. Paul G. Pearson

The purposes of this study have been (1) the comparison of the spatial and temporal distributions of Plethodon c. cinereus with those of Eurycea b. bislineata by means of field captures, and (2) a study of the vertical distribution of Plethodon within the soil as a means of interpreting the field captures, which were made on the surface.

Three approaches were used in this study, and they involved the use of: (1) a mark and release method in a field plot for a comparative study of the surface captures of Plethodon and Eurycea under natural conditions, (2) underground field cages, in which the vertical distribution of Plethodon could be measured under partially natural conditions, and (3) mazes, in which the vertical distribution of Plethodon could be measured under controlled simulated soil conditions.

It was found that Plethodon and Eurycea differed in (1) seasonal distribution, Plethodon captures occurring during the spring, during which time Eurycea captures were rare, (2) spatial distribution, Plethodon captures tending to occur away from the stream while Eurycea captures tended to occur near the stream, and (3) temperature range, Eurycea captures occurring over a wider range, $0^{\circ}C$ to $27.5^{\circ}C$, than Plethodon captures, which occurred from $5^{\circ}C$ to $25^{\circ}C$. Both species showed restricted home ranges.

It appears that the litter of the soil is only a minor part of the salamander's habitat even under favorable conditions. Within the underground field cages it was found that Plethodon are distributed within the soil, at least to a depth of 12 inches if they are given the opportunity to utilize water-free underground passageways. The Plethodon found on the surface or within the first inch of soil were but a small part of the population under plot, cage, and maze conditions. The occurrence of individuals upon the surface depended upon various environmental conditions of which light was the most important. The vertical distributions in the underground field cages were affected by water table level, surface cover and by low temperature. The presence or absence of light was not a significant factor in the distribution within the soil. Within the mazes vertical distributions were affected by light and by moisture and temperature gradients; preference was shown for cool wet substrates. If part of the temperature gradients exceeded $18^{\circ}C$, the salamander distribution was skewed toward the cooler temperature; the hotter the temperatures, the more sharply the distribution was skewed.

Hibernation survival depends upon the severity of the winter, 50% of the caged Plethodon survived during the winter of 1957 while none survived the winter of 1958 which was colder with less snow.

Experimentally-placed shelter objects, pine boards, rocks, and tar paper had approximately twice the efficiency of naturally occurring logs and rocks in yielding salamander captures. Microfilm $2.00; Xerox $5.00. 99 pages.

THE BIODYNAMICS OF SEDIMENTATION IN HORSESHOE LAKE, ISANTI COUNTY, MINNESOTA

(L. C. Card No. Mic 59-3767)

Bert Oram Thomas, Ph.D.
University of Minnesota, 1959

Adviser: Samuel Eddy

This study was undertaken to determine the annual production of plankton and higher aquatic plants in Horseshoe Lake, Isanti County, Minnesota, with special reference to the quantity of organic matter deposited annually in permanent sediments. Information was obtained concerning the quantity, sequence, chemical conditions, and biotic composition of the past sediments.

The original basin, resulting from glacial action, has changed by the accumulation of organic matter, largely a result of the biological productivity. All aquatic organisms contributed to this accumulation, but the plankton and higher aquatic plants are the most important agents.

This study was based on physical observations, biological determinations, and chemical analyses of the water and lake sediments. Collections of seston were made at two-week intervals, in most cases, from May, 1953, to February, 1958. Current abiosestonic sediment was collected under the ice by sedimentation traps. The annual production of higher aquatic plants was determined by a dry-weight-per-unit area method. Core samples at various levels of the bottom deposits were obtained with a Davis core sampler.

Horseshoe Lake comprises 114 surface acres and is a shallow, late-stage, eutrophic lake. It originated as a late stage Wisconsin glacial lake and is an ice block basin localized in a pre-glacial valley in the outwash of the Anoka Sand Plain. The carbon-14 dating of nearby lakes and peat bogs established the age of Horseshoe Lake as 11,830 $\pm$ 200 years.

The chemical conditions of the water showed a low carbonate content of from 28 to 38 milligrams per liter, and general low fertility.

The morphometric measurements from 142 stations showed the total volume of water in the present-day basin as 22,550,000 cubic feet and the total volume of sediments as 29,482,000 cubic feet. The maximum and mean depths were found to be 35.5 and 10.9 feet, respectivelv. Fifty-seven percent of the original basin is now filled with sediments.

The organic material which has been deposited was found to be 60 to 80 percent autochthonous. The sequence of sediments showed that organic matter production first occurred rather slowly, increased rapidly, and finally reached a period of equilibrium which has been maintained for some time. Changes were noted at approximately the end of the first quarter of the development of the lake and at the beginning of the last quarter.

The mean quantity of dry organic matter in the standing crop of total seston (mostly plankton) amounted to approximately 20.68 pounds per acre. When estimated to include the quantity for the entire year, 537.68 pounds per acre were produced. The annual mean quantity of dry organic matter collected in the sestonic sedimentation traps amounted to approximately 118.62 pounds per acre, or 13,522.68 pounds dry weight for the entire lake. The data obtained, however, suggested that approximately 78 percent of the material was lost in the water and 22 percent apparently settled to the bottom.

The total crop of higher aquatic plants was calculated to be 213,294 pounds dry weight for the area of the lake colonized with higher aquatic plants during the height of production. The mid winter higher aquatic plant crop was calculated to be 56,225 pounds dry weight. The difference between these two was assumed to be the amount that would contribute to the lake sediments. The lake displayed components of soft- and medium-hard water plants.

Seven and nine-tenths percent of the present-day sediment was derived from seston and seston decomposition products, while 92.1 percent was contributed by the higher aquatic plants.

Microfilm $2.15; Xerox $7.60. 161 pages.

DIFFERENCES IN THYROID FUNCTION OF SEVERAL STRAINS OF MICE

(L. C. Card No. Mic 59-4357)

Huberta Eva van Heyningen, Ph.D.
Brown University, 1959

The present investigation was undertaken to compare the degree of histological reaction of the thyroid after sulfadiazine feeding in several mouse strains with the normal functional activity of the thyroid in these strains. The degree of histological reaction, following two weeks of 0.5% sulfadiazine feeding, was appraised by Wilson (1952) as follows: minimal (+) for C_{57} mice, moderate (++) for BUC mice, fair (+++) for Y/HeWi mice, and extreme (++++) for BUB and C_3H mice. The normal function of the thyroid of these strains was assessed by measuring the I^{131} uptake and retention by the thyroid with an in vivo technique. The results for the I^{131} uptake indicated that BUB, BUC and C_3H mice have a larger uptake than C_{57} and Y/HeWi mice. From the I^{131} retention by the thyroid at consecutive intervals the slope of the retention line is calculated which gives an index for the rate of thyroid hormone output. It was found that the rate of thyroid hormone output of the different strains increases in the following order: BUC, Y/HeWi, C_3H, BUB, C_{57}.

The hypothesis was proposed that the strains which normally have a high thyroid hormone secretion rate would be most affected by the administration of a goitrogenic drug and thus would show the strongest histological reaction. However, the order in which the strains rank according to their normal thyroid hormone output rate does not coincide with the order of the strains according to their reaction to sulfadiazine. This does not support the above hypothesis. Consequently, the alternate hypothesis, that each strain has its own rate of thyroid hormone output and its own degree of histological reaction to sulfadiazine as two mutually independent parameters of the pituitary-thyroid axis, has to be accepted. This independence of the histological and the functional activity of the thyroid in the different strains is possible if the histological sensitivity of the thyroid to thyrotropic hormone and the functional sensitivity of the thyroid to thyrotropic hormone are different in each strain. Additional experiments in which histological and functional data from BUB and C_{57} mice after different durations of sulfadiazine feeding were

compared favor this explanation. A positive correlation was found between the histological activity and the rate of I^{131} output in the thyroid of C_{57} mice and a similar, but not identical, correlation between these two values was found for BUB mice. Another possible explanation for the independence of the histological and the functional activity of the thyroid in the different strains is that each strain may have its own limit of maximal thyrotropin production when the normal thyroxine inhibition is suspended by the goitrogen. However, in the present results there is no indication that C_{57} mice would have a lower limit of thyrotropin production than BUB mice since the I^{131} output rate of the C_{57} mice after sulfadiazine treatment is not lower than that of the BUB mice and also since the histological activity of the C_{57} thyroid after some intervals was found higher than that of the BUB mice.

In conclusion, the differences in normal thyroid hormone secretion rate and in degree of histological reaction of the thyroid to sulfadiazine between the mouse strains has to be ascribed to a strain difference in histological and/or functional sensitivity of the thyroid to thyrotropic hormone. Microfilm $2.20; Xerox $7.60. 165 pages.

ARTIFICIAL INCUBATION OF WILD BIRDS' EGGS AND DEVELOPMENTAL CONDITION OF NEONATES

(L. C. Card No. Mic 59-3872)

David Kenneth Wetherbee, Ph.D.
The University of Connecticut, 1959

Artificial incubation of eggs of about 100 species of birds is described. Egg weights, clutch weights, egg volumes, incubation periods, neonatal weights, mouth colors, interims between hatching and bone lengths of neonates and adults are reported. Differences in extents of development at hatching are described and some of the evolutionary correlates are discussed.

Eggs of probably all species of birds can be hatched successfully under artificial incubation at 37.8 C., 64 per cent humidity. Artificial incubation under standardized conditions eliminates ecological variables of "natural" incubation and permits gathering comparable data for many species. Mouth markings are found in only 4 neonates. Xanthophyll is apparently transmitted from yolk to skin of neonates. Size of egg does not affect length of incubation or extent of development at hatching within a species. The mouth lining may serve as an accessory respiratory organ in some neonates. Neonates of most species weigh 72 to 78 per cent of egg weight and contain large amounts of unassimilated yolk. Passerines have specific incubation periods of little variation that mostly fall between 280 and 370 hours with extremes represented by Blue Jay (406 hours) and Yellowthroat (256 hours). Although a fast rate of embryonic development may shorten the incubation period, a long incubation period does not produce a further advanced neonate. Commencement of incubation by the parent before the last egg of the clutch is laid probably exerts selective pressure for short incubation period because of intra-brood competition. The altricial condition in birds may have arisen through that mechanism. Some altricial birds have less ontogenetic distance to traverse in reaching maturity than some precocious birds. The extent of development at hatching is determined not only by the rates of character developments in the embryo and by the length of incubation period but also by the magnitude of total ontogenetic distance that adulthood represents for each character of each species, i.e. the whole life history of the organism and its biogenetic burden are involved in any real understanding of the developmental condition of young at hatching.

Microfilm $2.05; Xerox $7.20. 153 pages.

THE TAXONOMY OF WATER MITES OF THE GENUS ARRENURUS OF MIDDLE TENNESSEE

(L. C. Card No. Mic 59-4122)

James Lester Wilson, Ph.D.
Vanderbilt University, 1959

Supervisor: Professor Charles E. Farrell

The taxonomy of the genus Arrenurus of middle Tennessee is presented and the pertinent literature on North American representatives is given with regard to systematics, distribution, life history, ecology and behavior, and methods. Under distribution is a list of described species of Arrenurus for North America, including habitat, range, and location of type material, if known.

During the period between May 1955 and June 1958 551 collections were made in thirty-eight middle Tennessee counties. Water mites were found in 507 collections. Males of the genus Arrenurus were found in 190 of the 507 collections. The 190 collections were mostly from ponds and lakes, although five small rivers and four creeks yielded one positive collection each. One new species was taken exclusively from one of the rivers.

Ninety-two different locations or collecting stations were sampled with fifty-seven yielding male specimens of Arrenurus. Positive collections of Arrenurus were made in twenty-two counties. Collections from fourteen other counties contained water mites but no specimens of Arrenurus. Collecting was done largely during the summer months. No males of this genus were collected during January and February.

The 507 positive collections contained 34,246 water mites. Males of the genus Arrenurus numbered 10,130 specimens. Positive identification was made on 9991 male specimens of the genus. These specimens were identified as members of twenty-six previously described species and an additional four species which were identified as new. Also included is one additional series of rather distinct specimens, the position of which is not yet clear.

The thirty-one species represent the subgenera Arrenurus, Micruracarus, and Megaluracarus. No specimens of species in the subgenus Truncaturus were collected in middle Tennessee. The subgenus Arrenurus was represented by 454 specimens belonging to ten species: A. americanus, A. falcicornis, A. fissicornis, A. flabellifer, A. gennadus, A. laticornis, A. major, A. superior, A. trifoliatus, and one new species, the subgenus Micruracarus by 205 specimens belonging to six species: A. acutus, A. bicaudatus, A. infundibularis, A. laticaudatus, A. lyriger,

and A. muttkowskii, and the subgenus Megaluracarus by 9332 specimens belonging to fifteen species: A. apetiolatus, A. bartonensis, A. birgei, A. cardiacus, A. expansus, A. intermedius, A. manubriator, A. marshalli, A. megalurus, A. pseudocylindratus, A. semicircularis, three new species, and one series of specimens, the position of which is not yet clear. One subspecies was raised to the rank of species based upon data obtained during this investigation.

More than half of the male specimens of Arrenurus collected, 5590, were A. marshalli. A. birgei was next with 1511 specimens. Six species were represented by more than 100 specimens: A. apetiolatus with 891, A. intermedius with 472, A. bartonensis with 443, A. megalurus with 229, A. laticornis with 108, and one new species with 101. Ten species were represented by eleven or fewer specimens, with no species by less than two specimens.

In addition to a general description of the external morphology of water mites, a description is given of the external morphology of the males of the genus Arrenurus, with special emphasis on diagnostic or systematic characters useful in separating species or groups of species. A taxonomic key is given to the three subgenera of the genus represented in middle Tennessee, along with keys to the males of each of these subgenera.

In addition to a description and three diagrams, the following information is given about each species collected: reference to original description; location of type material, if known; habitat; range; a list of all middle Tennessee collections; diagnosis; remarks, if needed.

A discussion on the separation of species of this genus in middle Tennessee is given with regard to morphology, geographic location, reproductive isolation, and ecology.

Microfilm $2.95; Xerox $10.20. 227 pages.

A CONTRIBUTION TOWARD A KNOWLEDGE OF THE EMBRYOLOGICAL DEVELOPMENT OF THE CRAYFISH, CAMBARUS BARTONI SCIOTENSIS

(L. C. Card No. Mic 59-4249)

Elizabeth Margaret Zipf, Ph.D.
University of Virginia, 1959

The study is concerned with the gross features in the embryonic development of Cambarus bartoni sciotensis, C. longulus longulus, and C. montanus acuminatus, representatives of the Nearctic subfamily Cambarinae. Since our knowledge of the development of the crayfish is based almost exclusively upon investigations of the members of the genus Astacus, a European genus belonging to a separate subfamily, it seemed desirable to determine to what extent the development of members of the two genera were parallel and to determine what differences exist. Comparison to the embryonic development of Orconectes rusticus is also given. The major part of the work consists of an account of the daily external developmental changes of Cambarus bartoni sciotensis from oviposition to hatching and the morphological changes are summarized pictorially in camera lucida drawings. The eggs used in this study were obtained from egg-bearing females collected in the field, and from females that were induced to lay by removing their eyestalks. A technique was developed for securing adequate sections utilizing celloidin and paraffin imbedding and is described in detail. The most obvious difference between the development of Astacus and Cambarus is the longer period required by the former, a period of some 28-36 weeks. Development in Cambarus bartoni sciotensis, in contrast, is completed in only 30-35 days, those of C. longulus longulus and C. montanus acuminatus about 31-36 days. References are made to studies of the embryonic development of Orconectes rusticus and comparisons to its developmental period of 17.5 to 20 days. These differences are at least partially explained by the differences in the temperatures of their respective environments. The results of the investigation are compared in table form with previous studies on other species. It was observed that the blastopore does not give rise to the mouth in Cambarus; instead, it appears that the anus is dervived from the anterior extremity of the blastopore. This portion invades the presumptive thoracico-abdominal anlage where its anterior extremity forms the definitive anal orifice. The following day, it is seen that the anal orifice is located in the median lobe of the thoracico-abdominal anlage and later arrives at its definitive position through the terminal cleft on the posterior margin of the developing telson. Morphologically the thoracico-abdominal analage undergoes a series of changes from paired suboval anlagen that fuse to form a complex structure, from the base of which the gnathal region and its appendages are derived first, followed by the differentiation of the anlage into anteriorly-projecting lateral lobes that give rise to the ambulothorax and abdomen. From its lateral lobes arise the sterna, pleura, and appendages of the posterior five thoracic metameres. The abdomen and the terminal telson appear to be dervived from the median lobe, the presumptive caudal margin of which is displaced anteriorly.

Microfilm $2.00; Xerox $5.20. 104 pages.

FEEDING ADAPTATIONS IN THE BLACK SKIMMER (RYNCHOPS NIGRA)

(L. C. Card No. Mic 59-3970)

Richard Laurence Zusi, Ph.D.
University of Michigan, 1959

The purpose of this paper is to describe the feeding behavior of the black skimmer (Rynchops nigra) and some of the associated adaptations of the osteology and myology in the head and neck of this species. Comparisons of feeding behavior and anatomy are made with the royal tern (Thalasseus maximus), the gull-billed tern (Gelochelidon nilotica), and the laughing gull (Larus atricilla). Comments on the phylogenetic relationships of Rynchops are included.

Detailed studies of feeding behavior were undertaken in the field and were supplemented by analyses of slow-motion movies of feeding birds. Comparisons of the relative development of muscles and bones were made from drawings which were adjusted to the same body size. Body weight was the standard of body size used.

The black skimmer feeds almost exclusively by "skimming," i.e., flying low over the water with the lower mandible partially submerged. The upper mandible is protracted and is seldom submerged. When the lower mandible

strikes a fish or shrimp, the head doubles under the body and the jaws close on the prey. The black skimmer feeds at night as well as during the day. While feeding it is subject to environmental forces which seldom or never act on the other species.

The mandibles of the black skimmer are streamlined for ease of movement through the water. The tip of the rhamphotheca of the lower mandible grows rapidly and protrudes beyond the upper. The tip is broken off and worn from striking the bottom during skimming. The elongated lower mandible increases the chance of striking prey. Fish struck beyond the reach of the upper mandible are grasped when the head doubles under the body.

Ridges on the sides of the rhamphotheca of the lower mandible are believed to cause a slight vibration. This may be of use to the bird (particularly at night) by indicating the depth and angle of the submerged bill.

The jaws and palate of the black skimmer are hypertrophied, and the skull is variously modified to counteract forces acting on the jaws. Kinetic ability is increased by numerous adaptations, among which are reduction of the orbital process of the quadrate, the presence of a bony hinge on the ventral end of the nasal strut, and changes in the geometry of the palatal mechanism.

The jaw musculature is similar in the four species, although Rynchops shows a marked enlargement of most of the muscles. The pseudotemporalis profundus, however, is reduced, and its insertion is posterior to that of the pseudotemporalis superficialis. The depressor mandibulae tend to rock the quadrate forward, thereby aiding the protractor quadrati in protraction of the upper jaw.

The principal osteological adaptations of the neck are the general hypertrophy of the vertebrae and the modification of vertebra 4, thereby shortening segment I and lengthening segment II. This allows a more efficient action of M. complexus.

The neck muscles most important for skimming are the complesux, the splenius capitis, and the intertransversarii. All of these muscles show increased bulk, greater mechanical advantage, or both, in Rynchops. The general pattern of neck muscles, however, is similar in the four species.

The adaptations associated with feeding behavior in the black skimmer are diverse, and they are strongly independent. It is unlikely that these adaptations evolved separately; rather, the ancestral form which gave rise to Rynchops must have been preadapted in numerous ways for skimming. Gelochelidon and Thalasseus approach the structure of Rynchops more closely than does Larus, and it is hypothesized that ternlike birds, preadapted for skimming, gave rise to the Rynchopidae.

Microfilm $2.60; Xerox $9.00. 199 pages.

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